L0312400009 -- Cook Co.
PLOT M – PALOS FOREST PRESERVE
IL.D984903286
HRS/SF

(Volume 1 of 2)

CERCLA

Combined Assessment Report

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

COMBINED ASSESSMENT REPORT

for:

PLOT M – PALOS FOREST PRESERVE
PALOS HILLS, ILLINOIS

ILD 984903286

PREPARED BY:
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF LAND
FEDERAL SITE REMEDIATION SECTION
SITE ASSESSMENT UNIT

SEPTEMBER 16, 2003

COMBINED ASSESSMENT REPORT
PLOT M – PALOS FOREST PRESERVE

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

APPENDICES

1.0 INTRODUCTION

INTRODUCTION

On October 18, 2002, the Illinois Environmental Protection Agency's (IEPA) Office of Site Evaluation was tasked by the U.S. Environmental Protection Agency (U.S. EPA) to conduct a Combined Assessment (CA) of the Plot M - Palos Forest Preserve (ILD984903286) site located in Palos Hills, Illinois. The CA is performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300) requires a Preliminary Assessment (PA) be performed on all sites entered into the Comprehensive Environmental Response, Compensation, and Liability System (CERCLIS). If a detailed Site Inspection (SI) is considered necessary, and if site conditions warrant, the Combined Assessment is intended to:

1) Eliminate from consideration those sites that pose not threat to public health or the *environment*;
2) Determine the potential need for a removal action;
3) Set priorities for future investigations;
4) Gather existing or additional data to facilitate later components of the site assessment process

The Combined Assessment integrates PA/SI activities typically performed during the PA (information gathering, site reconnaissance) with activities typically performed during the SI (review of data, development of field work plans, field sampling, filling data gaps) to achieve one continuous site investigation.

If the determination is made that the site is NPL caliber, additional data will likely be needed to complete the assessment. A sampling plan to accommodate removal and site assessment needs, as well as initial remedial needs will be developed. The need for site sampling will be based on a reasonable understanding of the site in order to assure that adequate data will be collected for the removal assessment and the preparation of the Hazard Ranking System (HRS) score. The need for the initial sampling for the remedial investigation will also be considered. Upon completion of the data gathering, there will be a determination of whether the site should be forwarded within the Superfund process, either through the remedial or removal programs. Based on the preliminary HRS score and removal program information, the site will then either be designated as No Further Action (NFA), or carried forward as an NPL listing candidate.

The Combined Assessment will address all the data requirements of the revised HRS using field screening and NPL level Data Quality Objectives (DQO's) prior to data collection. It will also provide data in a format to support remedial investigation work plan development. Only sites that appear to score high enough for NPL consideration and that have not been deferred to another authority will move on to an Expanded Site Inspection (ESI).

On July 20, 1992 Plot M was placed on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) as a result of a discovery action initiated by the Illinois EPA in response to concerns that past site activities may have resulted in the release of chemical substances and radionuclides into the environment. These substances are associated with burial of chemical and radioactive laboratory waste material at the subject location. The site came to the attention of the IEPA as a result of a routine sampling program, conducted by Argonne National Laboratory, of hand pumped drinking water wells serving forest

preserve picnic areas near Plot M. Sample analysis indicated low levels of hydrogen-3 (as tritiated water) (tritium), in two of the wells. Argonne's current monitoring program began in 1980 consisting of collection and analysis of surface and subsurface water. In addition to Argonne collecting and analyzing mainly water samples, IEPA determined that collection of soil and sediment samples would provide information on additional media and result in a more comprehensive study of the Plot M area.

Material reportedly buried at the Plot M facility had/has the potential to enter the environment through four environmental pathways; groundwater, surface water, soil exposure and air releases thereby endangering the life and health of wildlife and human populations. The potential for contamination exists both onsite and in nearby offsite locations. This potential stemmed from a number of factors as follows: The facility was used for five years, during that time burial of radioactive wastes took place in trenches, waste was covered with an unknown thickness of soil, and no indication of liners being used. Access to the site is not restricted; and a few hand pumped drinking water wells exist within one-half mile of the facility.

In March 2003 the Illinois EPA's Office of Site Evaluation prepared a work plan for Combined Assessment (CA) field activities at Plot M. The work plan was submitted to U.S. EPA and approved. The field activity portion of the CA was conducted on April 8 - 10, 2003. The activities of the CA included a reconnaissance inspection, an internal file review, information collected from external sources and the collection of thirteen soil, fourteen sediment, and four groundwater samples from, both, on and off the Plot M site. All soil samples except two (the soil background) were collected on the Plot M site. Twelve of the fourteen sediment samples were obtained from the intermittent stream which runs past the site immediately to the east. The other two sediment samples were obtained from the I & M Canal approximately 2400

feet north of the Plot M site. Groundwater samples were collected from two monitor wells adjacent to Plot M and Non Responsive Non Responsive. Duplicate and background samples of each media are included in the number of samples mentioned above.

The Combined Assessment is being conducted to collect information sufficient to support a decision regarding the need for further action under CERCLA. The assessment will investigate & discuss the type of site, operational history, the four environmental pathways (groundwater migration, surface water migration, soil exposure and air migration), the environmental hazards associated with the site, and environmental samples collected by Argonne National Laboratory from 1980 through the present time from on and around the facility.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

The Plot M site is located east of the intersection of 107th Street, Archer Avenue/State Route 171, and State Route 83 near the City of Palos Hills, Illinois on property within the Palos Forest Preserve, Palos Township, Cook County (Figure 1). The site is located in a mixed, light industrial/low-high density residential urban/suburban setting west-southwest of Chicago. Some undeveloped areas also exist near the site (Figure 2). Plot M is situated in the center of the NW1/4, SW1/4 of Section 7, T.37N.- R.12E. The site occupies approximately 1.0 acre within timbered forest preserve. The plot is an open grassy area surrounded by mature trees. Plot M is situated on high ground between two intermittent drainage streams. A forest preserve footpath and bike trail cross over the center of the site in a north-south direction with another joining this trail from the west. Other trails are located nearby to the south. The site is bordered in all directions by timber for a minimum of one-quarter mile. From the site, and beyond the timber, Archer Avenue/SR171is 2100 feet directly north, 107th Street is 4000 feet to the south, Wolf Road is 4700 feet to the east, and Archer Avenue is 2200 feet directly west. Residential property exists in all directions within a four-mile radius of the site, except to the east. Single-family residences make up the majority of the residential property. Multi-family dwellings are interspersed within the four-mile radius of the site. The nearest individual and occupied structure is a single-family residence located approximately 5280 feet (one mile) north of the Plot M location.

Plot M had been used for the burial of radioactive waste in trenches from 1944 to 1948 and burial of steel bins containing these wastes during 1949. Use of Plot M ceased in the latter

part of 1949. Additional information can be found in Section 2.2, History, of this report. No above ground structures were built on the site.

The site's ground surface consists of soil, grass and some weeds, with bushes and trees at the perimeter. Bare soil is present mainly along the footpaths and bike trails crossing the site. Erosion has occurred along the sloped portions of the footpaths and bike trails leading to the top of Plot M. This is particularly evident at the top of the north and west slopes where one foot deep erosional gullies have been created, by site runoff, in the two foot thick clay/soil cap over Plot M. The approximate area of Plot M is defined on the sites ground surface by six granite stone markers, each measuring one and one half cubic feet in size. A large upright bolder, in the center of the Plot, commemorates its existence and also indicates no digging is allowed in the immediate area. Brush, weeds, briars and small trees are present as thick undergrowth along both sides (southwest and southeast corners of the site) of the entry path to the Plot. Mature hard wood trees with sparse undergrowth surround the remainder of the site at its perimeter. Plot M is accessible from all sides, however, a steep slope exists along the eastern perimeter of the site leading to the intermittent stream. The down cut of the channel is approximately 30 – 35 feet deep and at an angle of approximately 45 degrees. There have been no fences or structures erected to prevent access to the site. Plot M can be accessed by authorized vehicle, utilizing an access road (through a locked gate) from Archer Avenue or by bike or footpath via the forest preserve trail system.

While walking the site, air monitoring was conducted by use of a Foxboro Toxic Vapor Analyzer (TVA) meter. Monitoring of the breathing zone and near the soil surface registered nothing more than background readings (1 - 2 meter units). The site was also monitored for Gamma and Beta radiation with a Civil Defense (CD) V – 700 radiation detector. Monitoring

registered nothing above background readings (0.1 milliroentgens per hour (mr/hr)). No peculiar or extremely unusual site characteristics were noted during the survey. The only signs of recreational use on site are the foot paths and bike trails. No littering or signs of random dumping activities were noted. Soil on the facility consists of dark brown silty sandy loam, sandy clay, and some gravel.

The site is located in an area of northeastern Illinois where surficial terrain has been shaped by various types of glacial action and deposition. The land surface has been modified by glacial activity into relatively flat, to gently rolling, to steeply rolling terrain characteristic of glacial drift and moraine systems in the region. Plot M is situated on a moraine upland characterized by rolling terrain and dissected by two river valleys, the Des Plaines River Valley to the north and the Calumet Sag Valley to the south. The site surface is relatively flat and lies at approximately 710 feet above mean sea level (MSL) at the center. Streambed elevation of the intermittent stream immediately east of the plot is between 675 - 690 feet above MSL. The topography immediately surrounding the facility alternates between hills and valleys with basically the same elevations above MSL. At approximately one half mile north of the facility, one mile to the west, and three quarters of one mile to the south the terrain drops to 600 feet above MSL in the Des Plaines and Calumet Sag Valleys. The I & M Canal, into which the intermittent stream discharges, located approximately 2200 feet north-northwest of Plot M, has a normal pool level, according to the Army Corp of Engineers Rock Island District, of 580 feet above MSL. Flood stage, according to the Corp, is 599 feet above MSL.

Site slope is basically a radial pattern away from the center of the plot. Slope is only slightly detectable for the majority of the facility but more pronounced at the north end. Although some moisture will accumulate on the facility, in the form of puddles or surface

moisture and infiltrate into the silty, clay soil, most will run off site to the intermittent drainage routes. Surface water runoff routes are present along the east and west site boundaries flowing toward the north (Figure 3). Surface drainage follows the radial pattern then runs off site into the two intermittent streams. Both drainage routes trend north, joining approximately 300 feet north of Plot M and flowing north into the I & M Canal. The entire route of the intermittent stream flows through timbered terrain of the forest preserve. The drainage route begins south of Plot M at the former location of Site A. It flows north, past the eastern and northern perimeter of the site, past the eastern edge of the Red Gate Woods Picnic Area, through a wooded wetland area between Archer Avenue and the I & M Canal, and then into the I & M Canal. The wooded wetland exists from Archer Avenue, 700 feet, to the I & M Canal, totaling approximately two acres in size. The wetland is not contiguous to the I & M Canal, as it is separated by the raised bank of the I & M Canal. An asphalt hiking/biking trail is currently constructed on the top surface of the bank. A corrugated steel culvert directs flow under the canal bank from the wooded wetland. According to National Flood Insurance Maps the Plot M site is not located in any category of flood plain.

Overall land use within the four mile radius of the site is predominantly residential/urban to the north-northeast, north, northwest, west, and southwest. Areas south are mainly rural with scattered, small subdivisions beginning to be developed. Land designated as forest preserve is located to the southeast, east and east-northeast of Plot M. Industrial and commercial use is spread throughout the urban areas.

Appendix A provides a 4-mile radius groundwater migration map identifying areas of potential impact. A 15-mile surface water drainage route map identifying surface water migration is provided in Appendix B.

2.1.1 Reconnaissance Activities

On March 12, 2003, personnel of the Illinois EPA's Office of Site Evaluation conducted a reconnaissance inspection of the Plot M site and surrounding forest preserve area. Upon arrival the IEPA personnel entered the Red Gate Woods Picnic Area, north of the location of Plot M. Beginning along the east edge of the picnic area a footpath and bike trail meanders south through the timber to the site of Plot M. East of the picnic area and along the footpath/bike trail are groundwater monitor wells referred to as dolomite wells by Argonne. These are cased boreholes, which penetrate the dolomite bedrock allowing collection of groundwater from the bedrock aquifer. Ten are located near the picnic area; one is located approximately three hundred feet south of the picnic area; one is located approximately one hundred fifty feet north of Plot M; another is located approximately four hundred fifty feet southeast of Plot M; and the last is located approximately one thousand three hundred feet south of Plot M in Site A. Personnel from Argonne National Laboratory normally sample the boreholes quarterly to monitor the movement and/or concentration of any radionuclides in this aquifer (Reference Appendix E – Surveillance of Site A and Plot M – Report for 2001). The path leading to Plot M steadily rises from the Red Gate Woods Picnic Area as it also traverses various down cuts in the wooded terrain. The down cuts serve as area runoff channels leading to the intermittent stream down gradient of Plot M. Upon arrival at the Plot M site, IEPA personnel noted that monitor wells were placed at a number of locations around its perimeter. Twelve or thirteen of these wells are currently usable for collection of groundwater samples. These wells are finished in glacial drift, with the shallowest being thirty-six feet deep and the deepest being one hundred twenty-two feet deep. Personnel from Argonne National Laboratory also collect groundwater samples from these wells (approx. bimonthly) to monitor the movement and/or concentration of any radionuclides in

the glacial drift aquifer (Appendix E). All of the wells being used for sampling appeared to be in good condition. Areas included in the reconnaissance inspection were on-site soils, the surface water drainage routes leading from the site, the forest preserve areas near the site, the picnic areas near the site, and the I & M Canal.

2.1.2 Representative Interviews

Discussions regarding the Plot M site were conducted over the telephone on various occasions during March and early April 2003 between IEPA's OSE personnel and the Cook County Forest Preserve District, Argonne National Laboratory, the Illinois Department of Nuclear Safety, and USEPA Region V. Another short conversation took place with Argonne, USEPA, and Forest Preserve personnel on April 9, 2003 just prior to the day's actual site inspection sampling activities. IEPA, Argonne, USEPA, and Forest Preserve personnel arranged to meet at the Red Gate Woods Picnic Area parking lot on the morning of April 9th. The discussions and conversations were conducted to inform the site representatives (Argonne and the Forest Preserve) of IEPA's intentions, to talk about past, present and future activities and problems, explain the CERCLA site assessment process, and to point out proposed sampling locations. Argonne and Forest Preserve personnel were present to assist IEPA in any way they could and help locate monitor wells IEPA targeted for sampling. USEPA personnel were present to assist IEPA in monitoring the site and samples with hand held radiation detection equipment. The IEPA sampling plan proposed the collection of 14 sediment, 13 soil, and 6 groundwater samples from on and off site. Sediment samples were to be collected by stainless steel bucket auger or stainless steel trowel at various locations along the surface water drainage route (the intermittent stream) to determine if contamination is present along this route and attributable to

Plot M. The entire drainage route is situated in timbered Forest Preserve. Also being utilized at this site was the IEPA's Geoprobe, a direct push technology, for obtaining soil and groundwater samples. The Geoprobe, in addition to obtaining shallow soil samples, was to be used to collect soil samples up to 17 feet below surface grade in order to determine if contaminants are present in soil at depth surrounding the burial area and to determine if contaminants have migrated beyond the burial area. Groundwater samples were to be collected from four monitor wells adjacent to the plot and one picnic well in the Red Gate Woods Picnic Area. A number of monitor wells had been installed around the plot beginning in 1976. IEPA intended to collect one groundwater sample set from one monitor well on each of the four sides of the burial area. However, it was noted by Argonne personnel that two of the proposed wells might be dry due to the dry winter and spring. This information was found to be true. Therefore, IEPA personnel collected only two groundwater samples at the plot. In relation to the plot, both wells were in down slope locations. All groundwater samples were to be collected to determine if contaminants have migrated beyond site boundaries and into the local shallow aquifer.

2.2 SITE HISTORY

Plot M is a 150 foot by 140 foot area in Palos Forest Preserve formerly used for the burial of radioactive waste and radioactively contaminated laboratory articles. The waste was generated at the former site of Argonne National Laboratory and its predecessor, the University of Chicago's Metallurgical Laboratory. The site was part of the World War II Manhattan Project. The Laboratory used two locations in the Palos Forest Preserve; Site A, a 19 acre area that contained experimental laboratories and nuclear reactor facilities, and Plot M. The location of former Site A is approximately 1500 feet south of Plot M. Site A operations began in 1943

and ceased in 1954. Research programs conducted at Site A were reactor physics studies, fission product separations, hydrogen-3 recovery from irradiated lithium, and metabolism of radionuclides in laboratory animals. Plot M was used for burial of waste generated by the Site A programs. Burial of waste was carried out from 1944 to 1949. Waste was buried in trenches measuring 10 feet long by 6 feet deep by 3 feet wide and subsequently covered with soil as each trench was filled. No information exists indicating the number of trenches present at this location. Starting in 1948 waste was placed in steel bins which were then placed into trenches and buried. The bins were removed in 1949 and sent to Oak Ridge National Laboratory for disposal. The waste not contained in bins was allowed to remain in place. No additional disposal activities were conducted at this location after 1949. Records pertaining to exact inventory of items placed into the trenches at Plot M are incomplete, however, known items include animal carcasses, building debris, clothing, contaminated equipment, radioactive materials, and various hazardous materials such as lead and various solvents. The former laboratory site and Plot M were decommissioned in 1956. As part of this process, the reactor fuel and heavy water used for neutron moderation and reactor cooling at Site A were removed and shipped to Oak Ridge National Laboratory. The biological shield for the reactor along with various pipes, valves, and building debris was buried in place at Site A. Also, in 1956, as part of the decommissioning of Plot M, eight foot deep concrete side walls were poured around the perimeter of Plot M with a one foot thick concrete slab poured over the top. A two foot thick cover of high clay content soil was then placed over the concrete slab and seeded with grass.

2.3 PREVIOUS INVESTIGATIONS

In 1973 elevated levels of hydrogen-3 (tritium) were detected in two hand pumped picnic wells located approximately 1200 feet and 1700 feet north of Plot M. Further investigation at that time and a radiological characterization of the area in 1976 - 1978 concluded that this contaminant was migrating from Plot M into the surrounding soil and aquifer. As a result, Argonne National Laboratory initiated a radiological surveillance program of the Palos Forest Preserve area with emphasis on Site A and Plot M. This program was initiated in 1980 and consists of collection and analysis of surface water and ground water samples.

Information based on continued monitoring by Argonne indicate radioactive dose levels in established forest preserve wells, monitor wells installed by Argonne, and surface water/sediment are below established U. S. Department Of Energy Radiation Protection Standards for annual exposure from hydrogen-3. In 2001, as part of the annual monitoring of Plot M and the surrounding area, Argonne collected 340 samples from the mentioned sample media. Some samples were collected biweekly, others annually. Sample results are compared to the U.S. Department of Energy Radiation Protection Standard for hydrogen-3 of 100 millirems/year or in the case of ground water, the U. S. EPA drinking water limit of 20 nanocuries/L. Annual exposure rate is calculated by multiplying the sample concentration by the general public water ingestion rate of 730 liters/year, then multiplied by the 50-year Committed Effective Dose Equivalent (CEDE) factor for hydrogen-3 of 6.3×10^{-5} rem/uCi. This monitoring program has continued through present day from 1976.

In 1988 the picnic well closest to Plot M (and an established picnic pavilion) was removed from service due to fecal coliform contamination, not because of contaminants associated with Plot M. A new well was installed later that year, which then was removed from

service in 1999 for the same reason as the previous well. Other forest preserve wells in the area have also been removed from service due to migration of fecal coliform contaminants from restroom facilities (septic systems) at the forest preserve picnic area.

2.4 REGULATORY STATUS

Based on available information the Plot M site does not appear to be subject to Resource Conservation & Recovery Act (RCRA) corrective action authorities. Information currently available also indicates that the facility was not subject to the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), Atomic Energy Act (AEA), or Uranium Mine Tailings Radiation Control Act (UMTRCA).

3.0 COMBINED ASSESSMENT ACTIVITIES

3.1 SAMPLING ACTIVITIES

On April 8 – 10, 2003 Illinois EPA personnel collected a total of thirty-one samples from the Plot M site, the intermittent stream, the Red Gate Woods Picnic Area, and the I & M Canal. Samples collected consisted of eleven soil samples, six shallow (includes one duplicate) and five at depth from the Plot M site; two soil samples in the Red Gate Woods Picnic Area, one shallow and one deep; six additional deep soil samples (five on site and one off site) for radiological analysis; twelve sediment samples (includes one duplicate) from within the intermittent stream running past the plot, two sediment samples in the I & M Canal; two groundwater samples collected from monitor wells located adjacent to Plot M; and two groundwater samples (includes one duplicate) collected from Red Gate Woods Picnic Non Responsive. The on site samples (Figures 4 & 7) were collected to help determine the type of contaminants present and concentration of the contaminants. Off site samples (Figures 4 –7) were collected to determine if facility contaminants have migrated beyond the boundaries of Plot M.

3.1.1 Soil Samples

The soil background sample was located up slope of the main facility area and of the other sample points, and serves as a baseline for constituents that may be common in area soils. The shallow soil samples were collected from between four and six feet in depth to determine if contaminants were either placed near the soil surface or were migrating toward the soil surface. The deep soil samples were collected from between fourteen and seventeen feet in depth to determine if TCL contaminants were migrating beyond the eight foot deep concrete walls constructed around the Plot M trenches. Figures 4 & 6 illustrate the locations of each soil sample

collected during the April 8 – 10, 2003 CA investigation. Table 1 provides an overall summary of the April 2003 soil sample analytical results. Also provided on Table 1 are highlighted results indicating key samples in which contaminants were detected at concentrations exceeding specific background levels or benchmarks. Table 4 describes each soil sample with its location, depth, and physical appearance.

3.1.2 Radiological Samples

In addition to analysis for TCL constituents, radiological analysis was performed on the six deep soil samples (X102, X104, X106, X108, X111, and X113). These samples were collected to determine if radioactive material is migrating beyond the aforementioned concrete walls. Figures 4 & 6 illustrate the locations of each radiological (soil) sample collected during the April 8 – 10, 2003 CA investigation. Gross Alpha, Gross Beta and Total Gamma scan analysis were completed on each sample. Table 1-a provides a summary of the April 2003 radiological (soil) sample analytical results. Also provided on Table 1-a are highlighted results indicating key samples in which contaminants were detected at concentrations exceeding specific background levels or benchmarks. Table 4 describes each radiological (soil) sample with its location, depth, and physical appearance.

3.1.3 Sediment Samples

Sediment sampling consisted of collecting a total of fourteen samples, twelve samples in the intermittent drainage ditch that flows adjacent to the site, terminating in the I & M Canal, and two samples in the I & M Canal (Figure 5 & 6). One sample was collected upstream of Plot M; seven samples were collected in close proximity to the site side slopes; four samples were

collected along the drainage route through the forest preserve; and two samples were collected in the I & M Canal, one upstream of the confluence with the intermittent stream and one downstream. All sediment samples were analyzed for Target Compound List constituents. Sediment sample X214, the upstream sample in the intermittent stream, is designated as the background comparison sample. Sediment samples from the intermittent stream (X203 – X214) were collected from depths between sediment surface and 4 inches below sediment surface in water varying from one half inch deep to six inches deep. At various times of the year this stream carries no water. During the April 8 – 10, 2003 sampling event the stream had a steady flow of water. Samples from the I & M Canal (X201 & X202) were collected from depths between 2 and 8 inches below the surface of the sediment in approximately one and one half feet of water. Sediment samples were obtained to determine if any potential site contaminants were migrating off site via overland flow or groundwater to surface water migration. Figures 5 & 6 illustrate the locations of each sediment sample collected during the April 8 – 10, 2003 CA investigation. Table 2 provides an overall summary of the April 2003 sediment sample analytical results. Also provided on Table 2 are highlighted results indicating key samples in which contaminants were detected at concentrations exceeding specific background levels or benchmarks. Table 4 describes each sediment sample with its location, depth, and physical appearance.

3.1.4 Groundwater Samples

Groundwater sampling consisted of collecting four samples at three locations. Two monitor wells were sampled at the site and one forest preserve well was sampled in the Red Gate Woods Picnic Area (Figure 7). A duplicate sample was also collected from the picnic area well.

One monitor well sampled at the Plot M site is located approximately 30 feet west of the northwest corner stone marking the corner of the concrete cap covering the site (G102 (Argonne well #26)), the other is located approximately 75 feet north of the northern edge of the site (G101 (Argonne well #4)). The picnic well is located approximately 1200 feet northwest of the Plot M site. All groundwater samples were analyzed for Target Compound List constituents. Groundwater samples were collected to determine if contaminants from the facility have migrated to local groundwater. Figure 7 illustrates the locations of each groundwater sample collected during the April 8 – 10, 2003 CA investigation. Table 3 provides an overall summary of the April 2003 groundwater sample analytical results. Also provided on Table 3 are highlighted results indicating key samples in which contaminants were detected at concentrations exceeding specific background levels or benchmarks. Groundwater flow direction was not determined during this event. Therefore, a background location for groundwater was not established. Because sample results could not be compared to any background data they were compared to established Title 35, Subtitle F, Chapter I: Illinois Pollution Control Board, Part 620 Class I Groundwater Quality Standards.

3.2 ANALYTICAL RESULTS

The eleven soil samples collected from the Plot M Site (Figure 4 & 6) revealed: a few volatile constituents detected at low estimated concentrations and a few at or exceeding respective detection limits; no semi-volatile constituents above detection limits; no pesticide/PCB constituents above detection limits; and a number of inorganic constituents above detection limits (Table 1). All soil samples were analyzed for the Target Compound List constituents (Appendix C). Off-site soil samples (Figure 6), X112 and X113, revealed the same

constituent detection for each analyzed fraction as the on-site samples. Samples X101 and X102 were designated as the background location for soil samples, shallow and deep, respectively. This location was designated as the background due to it being upslope from the plot and the other sample points. Samples X103 - X113 contain various volatile constituents at low estimated detectable levels and/or at quantitative levels greater than or equal to background detection limits (Table 1). No semi-volatile or pesticide/PCB constituents exceeded associated detection limits in any of the samples. All soil samples contain inorganic constituents at levels in excess of corresponding background detection limits. Further review indicates that none of the samples, containing volatile or inorganic constituents exceeding the detection limits, are in excess of calculated, observed release values.

Results of the radiological analysis of deep soil samples indicate that total radium concentrations are slightly elevated at 4.7 pCi/g in X102 (the highest total radium level of this sample set), but do not exceed the general USEPA cleanup level of 7 pCi/g for total radium. The Gross Alpha and Gross Beta scans indicated normal background levels (below 10 pCi/g) in all samples except X106, which was noted at 165.52 pCi/g. The elevated level is not explained by the analytical results associated with the Uranium Decay Series radionuclides (Ra-226, Bi-214, Pb-210) or by the Thorium Decay Series radionuclide (Ra-228). Further analysis is necessary to determine the cause of the elevated reading in X106.

Sediment sample analysis (Table 2) indicated detectable volatile constituents present in samples X202, and X206 – X213. Sample X202 contained one constituent with a quantitative concentration which exceeds its associated background concentration. Samples X206 – X213 contain one volatile constituent each at low estimated detectable concentrations, not exceeding associated background concentrations. At least one detectable semi-volatile constituent was

present in each of the following samples; X201, X202, X207, X208, and X210. Analysis indicates that a number of semi-volatile constituents in samples X201 and X202 contain estimated concentrations, with one quantitative constituent found in X201 exceeding its associated background concentration. Samples X208 and X210 each contain one semi-volatile constituent with a quantitative concentration exceeding the associated background concentration. Three pesticide constituents were detected in samples X201 and X202 which exceed associated background concentrations. Numerous inorganic analytes were detected with both, estimated and quantitative concentrations, in all sediment samples collected. Five samples, X201, X202, and X208 – X210 contained at least one detected constituent exceeding its respective background concentration. Even though the detected constituents indicated in the volatile, semi-volatile, pesticide/PCB, and inorganic fractions of samples X206 – X213 are of quantitative concentrations and in excess of their respective background concentrations, they are not considered observed releases due to the receiving waterway being an intermittent stream located in a climate producing in excess of 20 inches of rain per year. Although some of the contaminants detected in sample locations in the intermittent drainage route adjacent to and downstream of Plot M were similar to those detected in some soil samples collected from the Plot M site, the downstream concentrations indicate that they may not be undeniably attributable to the Plot M Site.

All groundwater samples (G101 – G104) were analyzed for Target Compound List constituents. Analysis of these samples indicated a few volatile constituents were detected in sample G101, but none in the other samples (Table 3). None of the detected constituents exceeded indicated benchmarks. Sample analysis indicated no detectable semi-volatile constituents were present in these samples. Analysis of pesticide/PCB and inorganic fractions

could not be completed for samples G101 and G102 due to lack of adequate water volume in the respective monitor wells. Sample analysis indicated no detectable Pesticide/PCB constituents were present in samples G103 and G104. In addition to collecting a sample for total inorganic analytes (total metals) at each well (G103 & G104), a field filtered (dissolved metals) sample for inorganic analytes was also collected. A number of inorganic analytes were detected in all analyzed groundwater samples. A few of the detected constituents in samples G103 and G104 exceed their respective Class I Groundwater Quality Standards. These results, however, do not determine attribution to site contaminants.

For a list of analyzed compounds and semi-volatile compounds considered to be PNA's, please refer to the Target Compound List found in Appendix C.

Any constituents with concentrations exceeding corresponding benchmarks are highlighted in Tables 1, 1-a, 2, & 3, the Soil, Radiological (soil), Sediment, and Groundwater Sample Summary Tables, respectively. Detected constituent concentrations which are not highlighted, are below action levels. A complete analytical data package for the Plot M site is located under a separate cover in Volume 2 of the CA report.

Photos of IEPA's April 2003 sampling event are located in Appendix D of this report.

3.3 ADDITIONAL DATA

In addition to IEPA's analytical results for Plot M, analytical results of surface water and groundwater sampling is available from Argonne National Laboratory. Surface water samples (when water is present in the intermittent stream) and borehole samples are collected at various times throughout the year by Argonne National Laboratory as part of an ongoing monitoring and

surveillance program of the Plot M site (1980 – present). Current as well as historic surface water sample results indicate that hydrogen-3 concentrations vary from year to year, and are dependent on the amount of precipitation received by the watershed. Analytical results also indicate that concentrations: are low upstream of the Plot, increase as the stream flows past the Plot due to Hydrogen-3 leaching from the burial site via a small seep, then decrease downstream as a result of dilution by surface water run off. Surface water samples collected by Argonne throughout each year are all analyzed for hydrogen-3. The detection limit is 0.1 nCi/L. Analytical results of surface water samples collected upstream and downstream (150 feet prior to the confluence with the I & M Canal) of Plot M indicate hydrogen-3 concentrations ranging from below the detection limit up to 3.0 nCi/L. Samples adjacent to, and up to a distance of approximately 300 feet downstream of, Plot M indicate hydrogen-3 concentrations ranging between 0.3 nCi/L to 66.9 nCi/L. Even though some of the concentrations significantly exceed the detection limit of hydrogen-3 they are not considered releases to surface water due to the receiving stream being classified as intermittent. Argonne's surveillance program continues to indicate that remaining radioactivity at Plot M, although present, is not a danger to human health and the environment.

Borehole samples are collected at various times throughout the year by Argonne National Laboratory as part of the ongoing monitoring and surveillance program of the Plot M site. Current as well as historic sample results indicate hydrogen-3 concentrations vary widely, due to groundwater levels and corresponding water levels in each of the monitor wells sampled during different times of the year. Almost all sample results were in excess of the 0.1 nCi/L detection limit. Strontium-90 concentrations greater than the detection limit (0.25 pCi/L) were found in five of thirteen wells sampled. The data suggest that small but measurable amounts of

radioactivity have migrated from the burial site into the surrounding glacial till. The surveillance program continues to indicate that remaining radioactivity at Plot M, although present, is not a danger to human health and the environment.

Please refer to Appendix E for the 2001 edition of information and analysis of surface water samples collected from the intermittent stream adjacent to Plot M and borehole samples collected on and near Plot M.

Three laboratories were used to perform analysis of samples collected by IEPA during the April 2003 Plot M CA. The organic fractions of the soil, sediment, and groundwater samples were shipped to Ceimic Corporation in Narragansett, Rhode Island for analysis. The inorganic fractions of the soil, sediment, and groundwater samples were shipped to Bonner Analytical Testing Company in Hattiesburg, Mississippi for analysis. The soil samples to be analyzed for radiological activity were shipped to American Radiation Services, Inc. in Baton Rouge, Louisiana under contract from Applied Research & Development Laboratory (ARDL) of Mt. Vernon, Illinois. All sample containers arrived in their respective coolers intact and chilled to the protocol temperature of 4 degrees Celsius. Each laboratory met the sample turnaround time of 21 days.

4.0 SITE SOURCES

This section includes descriptions of the various hazardous waste sources that have been identified at the Plot M site. The Hazardous Ranking System defines a "source" as: "Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from the migration of a hazardous substance." This does not include surface water or sediments below surface water that has become contaminated.

Information obtained during the Combined Assessment identified two separate areas considered to be sources of contamination at this facility, Landfill (Buried Trenches) and Contaminated Soil. As additional information becomes available, the possibility exists that additional sources of contamination may be revealed.

4.1 LANDFILL (BURIED TRENCHES)

Disposal of radioactive waste and radioactively contaminated laboratory articles into excavated trenches at Plot M is suspected of leading to the migration of contamination into the surrounding soil and the intermittent stream adjacent to the site. For HRS purposes, these trenches are considered a landfill due to the assumption that the trenches were backfilled or by contemporaneous deposition of waste and soil. During the April 8 – 10, 2003 sampling event no samples were collected directly from the trenches as they are surrounded with eight foot deep concrete walls, covered with a one foot thick concrete cap and then covered with two feet of clay soil. Only the bottom remains open.

Although the burial area is enclosed by concrete on all sides except the bottom, and sample results of surrounding soil samples, both shallow and deep, do not indicate migration of TCL contaminants beyond the concrete walls, the landfill/buried trench area will remain a

potential source of contamination due to the material reportedly buried at this location. Also contributing to this determination is the sites accessibility and it being on foot and bike paths.

The landfill/buried trenches source is not prone to frequent flooding (100-year flood) as documented by National Flood Insurance Program Maps of Cook County.

Based on the HRS definition of a source and measurements from known points of site delineation (granite markers on the site surface) the source has been calculated to be an area of approximately one half acre (21,000 square feet).

4.2 POTENTIAL CONTAMINATED SOIL

During the April 8 – 10, 2003 sampling event eleven soil samples (including one duplicate) were collected from various locations on the Plot M site. Two additional soil samples were collected from the Red Gate Woods Picnic Area. Both, shallow and deep samples were collected from each respective soil boring. Four of the five boreholes used for the eleven soil samples at the site were situated immediately adjacent to the concrete walls surrounding the buried trenches. Six samples (including the duplicate) were collected from "shallow" borings around Plot M between four feet and six feet in depth. Five samples were collected from "deep" borings between fourteen feet and seventeen feet in depth. Four of the five deep samples were collected from between four and seven feet below the bottom of the concrete walls. One shallow and one deep soil sample was collected from the picnic area location. A scan for radionuclides was conducted on the six deep samples (five at Plot M and one at the picnic area), accomplished through use of handheld radiation detectors. All sample readings indicated normal, naturally occurring emission levels. For all deep samples, a separate volume of soil was collected for laboratory analysis to confirm the results of radiological field screening.

Analysis of collected soil samples for Target Compound List constituents indicated various contaminants at estimated detectable concentrations and others at quantitative levels greater than or equal to background detection limits (presented in the Background columns in Table 1 and described at the bottom of the table). None of the concentrations in any of the samples exceed calculated background concentrations (observed release criteria) (refer to Table 1 as noted above) nor are they in excess of USEPA Removal Action Levels (Table 1).

Although the soil samples, both shallow and deep, do not indicate migration of contaminants beyond the burial area, and have not been detected within two feet of the soil surface, the potential remains due to the material reportedly buried at this location. Also contributing to this determination is the sites accessibility and it being on foot and bike paths. There may also be a potential for soil contamination to exist along the intermittent stream due to its proximity of Plot M's eastern and northern side slopes being contiguous with the stream.

The site area is not prone to frequent flooding (100-year flood) as documented by National Flood Insurance Program Maps of Cook County.

Based on the HRS definition of a source and measurements from known points of site delineation (surface points collected by GPS on the site perimeter) the source has been calculated to be an area of approximately one acre (43,560 square feet).

5.0 MIGRATION PATHWAYS

The Office of Site Evaluation identifies three migration pathways and one exposure pathway, as identified in CERCLA's Hazardous Ranking System, by which hazardous substances may pose threat to human health and/or the environment. Consequently, sites are evaluated on their known or potential impact to these pathways. The pathways evaluated are groundwater migration, surface water migration, soil exposure, and air migration.

5.1 GROUNDWATER

According to publications of the Illinois State Geological Survey (ISGS) and the Illinois State Water Survey (ISWS) the Plot M site is situated on a moraine upland characterized by rolling terrain and dissected by two river valleys, the Des Plaines River Valley to the north and the Calumet Sag Valley to the south. The area is underlain by glacial till and drift deposits over bedrock. Site M is positioned on the Clarendon Moraine of the Joliet Sub-Lobe of the Lake Michigan Lobe of Wisconsinan age. The drift material of the Clarendon Moraine consists of clayey gray till (Wadsworth Till) with some sand and gravel intervals throughout. These deposits range from approximately 130 feet thick beneath Plot M to zero at the I & M Canal (in the Des Plaines River Valley) and the Calumet Sag Channel. The Wadsworth Till is overlain by the Richland Loess which is approximately 1 – 2 feet thick in the area surrounding Plot M. The moraine deposits in the immediate area are underlain by Silurian dolomite approximately 200 feet thick. Underlying the Silurian dolomite is the Maquoketa Group consisting of interbedded shale and limestone approximately 150 feet thick. The Galena-Platteville Groups consisting of dolomite and limestone formations approximately 325 feet thick underlies the Maquoketa Group. Based on the geology beneath the site two aquifers exist, a shallow glacial drift and till aquifer to

approximately 130 feet in depth, and the deeper Silurian dolomite aquifer from approximately 130 feet to 330 feet below surface grade.

During years with normal precipitation amounts, depth to groundwater, in various shallow groundwater monitor wells, at Plot M, ranges from approximately seventeen to forty-eight feet below ground surface. Groundwater measurements have been recorded for a number of monitor wells, on-site and in the immediate area, since 1982. Groundwater monitoring is part of an on-going site monitoring program conducted by Argonne National Laboratory. According to the ISGS, the ISWS, and in agreement with current and past water level measurements, groundwater flow direction in the shallow glacial till/drift aquifer is north toward the I & M Canal in the Des Plaines River Valley. Groundwater flow direction in this area is controlled significantly by topography. Groundwater flow within the dolomite aquifer is dictated by the recharge/discharge areas and capacities of the Des Plaines River Valley and Calumet Sag Valley and the south to southwest trend of the local bedrock surface. Locally the bedrock surface varies from 600 – 550 feet above mean sea level. Flow toward or away from the respective valleys depends on recharge of groundwater into the dolomite from the shallow glacial till/drift. At the time of the April 8 – 10, 2003 Combined Assessment groundwater level was measured at thirty-one feet below surface grade in Argonne well #4 (IEPA G101) and fifty-four feet below surface grade in Argonne well #26 (IEPA G102). Both wells are finished in the glacial till. An unusually dry previous year is cited as the cause of the low groundwater levels. Groundwater in the glacial till/drift aquifer may ultimately discharge into the I & M Canal and Des Plaines River.

Drinking water for the majority of the population within four miles of the Plot M site is obtained from Lake Michigan, which is treated and supplied by the City of Chicago. There are, however, numerous private drinking water wells and a few community water supply systems

within four miles of the site. The nearest private well is located approximately 7280 feet southwest of Plot M. These residential drinking water wells, as well as the others within four miles of Plot M, are finished in the same Silurian dolomite bedrock as the Red Gate Woods Picnic Area wells. ISWS records indicate residential drinking water well depths are between approximately 90 and 250 feet below ground surface, penetrating into the dolomite from 5 feet to 175 feet. IEPA in cooperation with the U. S. Geological Survey (USGS) has developed a Source Water Assessment Program (SWAP) which provides data on drinking water, the systems that provide the water, location of systems, and other pertinent information. The SWAP data indicates that three community water supply systems exist within four miles of Plot M. These include Holy Family Villa, Franciscan Sisters of Chicago, and the Southeast Regional Water Facility. The wells in each of the three community water systems extract water from the shallow dolomite aquifer. The Holy Family Villa system consists of two active wells (one 295 feet deep, the other 350 feet deep) located 2.5 miles south of Plot M, serving 200 residents. The Franciscan Sisters of Chicago system consists of two active wells (one 220 feet deep, the other 250 feet deep) located 3.9 miles southwest of Plot M, serving 530 residents. The Southeast Regional Water Facility (SRWF) system has three active wells and one inactive well within the four mile target distance limit of Plot M. The three active SRWF wells of concern are located 3.9 miles (Well #1) and 3.7 miles (Wells #2 & #3) northwest of Plot M, serving an estimated 17,260 residents.

Approximately 1003 private wells (serving 2764 people) using the shallow dolomite bedrock aquifer are located within four miles of the Plot M site. Total population using the shallow dolomite aquifer is 20,754. There have been no reports of groundwater contamination of private wells in the area.

As stated previously, area groundwater has been monitored by Argonne National Laboratory since 1982. Monitoring consists of obtaining groundwater level measurements and collection of groundwater samples from numerous monitor wells, on-site and off-site, as well as collection of groundwater samples from approximately fifteen hand pumped forest preserve wells (Reference Appendix E – Surveillance of Site A and Plot M – Report for 2001). All wells were analyzed for inorganic constituents, hydrogen-3, and strontium-90. Argonne's analytical results indicate that site monitor wells contain various inorganic constituents in excess of respective detection limits, widely varied concentrations of hydrogen-3 in excess of the 0.1 nCi/L detection limit, and strontium-90 concentrations greater than the detection limit of 0.25 pCi/L have been found in five of the thirteen sampled wells during 2001. Argonne's analytical results from three hand pumped forest preserve wells situated down gradient of Plot M indicate low level concentrations of hydrogen-3 (tritium in water) in excess of the detection limit of 0.1 nCi/L. Analysis of samples collected from the other forest preserve wells located south and east of Plot M indicate hydrogen-3 concentrations less than the detection limit. IEPA's analytical results indicate a few volatile constituents were detected in sample G101, but none in the other samples (Table 3). None of the detected constituents exceeded indicated benchmarks. Sample analysis indicated no detectable semi-volatile constituents were present in these samples. Analysis of pesticide/PCB and inorganic fractions could not be completed for samples G101 and G102 due to lack of adequate water volume in the respective monitor wells. Sample analysis indicated no detectable Pesticide/PCB constituents were present in samples G103 and G104. A number of inorganic analytes were detected in all analyzed groundwater samples. A few of the detected constituents in samples G103 and G104 exceed their respective Class I Groundwater Quality Standards.

A listing of the number of public and private wells and approximate number of users in each distance category are presented below.

Number of wells and users within 4-miles of Plot M – Palos Forest Preserve

Distance	Groundwater Wells	Private Well Population	Public Well Population
0 - 1/4 mile	0	0	0
1/4 - 1/2 mile	0	0	0
1/2 - 1 mile	0	0	0
1 - 2 miles	115	416	0
2 - 3 miles	384	1042	200 (Holy Family Villa)
3 - 4 miles	464	1253	530 (Franciscan Sisters)
			17,701 (S.E. Reg. Water Fac.)

The population was calculated using USGS topographic maps for the area surrounding the facility, the Illinois State Water Survey Private Well Data Base and 2.73 people per household in Du Page County and 2.68 people per household in Cook County, as established by the U.S. Census Bureau (2000).

5.2 SURFACE WATER

The surface water pathway consists of intermittent drainage channels on the west (X207) and east site perimeters (X203 – X206 & X208 – X214), and the I & M Canal (X201 & X202). Figures 3, 5 & 6 illustrate the drainage route and area characteristics. The area around the facility is undulating glacial end moraine with slopes ranging from slight to severe. Drainage patterns are well defined throughout the area. Moisture contacting the soil surface in the area tends to run off rather than infiltrate due to a high silt and clay content of the glacial till. Much

of the area runoff terminates in the I & M Canal. As mentioned previously, the site surface is relatively flat and lies at approximately 710 feet above mean sea level (MSL) at the center. According to the Army Corp of Engineers Rock Island District, flood stage is 599 feet above MSL. The site is not within a flood plain.

The majority of surface water runoff from Plot M tends to flow toward the north and east. Site slope is evident toward the north and east portions of the site, however, definite degree of slope at the west and south portions are not as perceptible. Drainage patterns originating adjacent to the site are detectable by reviewing topographic maps and, to a lesser extent, aerial photographs unless using photographic stereopairs. Visual verification, during reconnaissance of the site, indicates that facility slope is as stated above. Drainage from the site flows north and east via overland flow toward the aforementioned intermittent drainage ditch and then winds north through the wooded forest preserve. Runoff then enters a wooded wetland area (within the forest preserve) north of the Red Gate Woods Picnic Area, north of the Plot M site. Drainage from this area then flows to and into the I & M Canal (a perennial drainage way). The point at which surface water runoff from Plot M enters the I & M Canal is identified as the probable point of entry (PPE) to surface water and is located between sample points X201 and X202. The PPE is located approximately 2200 feet (0.42 miles from the site) north-northwest of the site's northern perimeter. The I & M Canal then flows west-southwest for the 15-mile in-water segment of the surface water route. There are no surface water intakes along the 15-mile in-water segment of these surface water bodies. Fisheries have been identified to be in the 15 mile in-water segment of the I & M Canal. Wetlands exist, in a segment of the intermittent drainage ditch between Archer Avenue and the I & M Canal; and along and outside of one or both banks of the I & M Canal, as palustrian, forested, broad-leaved deciduous, temporarily

flooded areas. Other wetland classifications assigned along and outside of one or both banks of the I & M Canal are palustrian, emergent, seasonally or temporarily flooded environments. Within the I & M Canal channel the classification assigned is riverine, lower perennial, unconsolidated bottom, permanently flooded environments (Figure 6). Please see Sections 3.2 and 3.3 of this report, Analytical Results and Additional Data, respectively, for additional information on sediment and surface water sample results respectively.

5.3 SOIL EXPOSURE PATHWAY

Soil sample analytical results from the April 2003 CA indicate no observed releases to the soil exposure pathway. In addition, no concentrations of detected constituents exceed USEPA Removal Action Levels (RAL's). As stated previously, shallow samples collected from Geoprobe borings around Plot M were from between four feet and six feet in depth. The deep samples were from between fourteen feet and seventeen feet in depth. Shallow and deep soil samples collected by IEPA on the Plot M site and analyzed for TCL constituents revealed no contaminants above calculated background limits or specific detection limits. Current analytical data (Table 1 and Figure 5), associated with these sample locations, compared with previously collected data (Appendix E) from the Argonne National Laboratory monitoring program indicate that the site is not a risk to human health and the environment.

Prior to site use being discontinued in 1949 various workers may have been exposed to the radioactive waste and radioactively contaminated laboratory articles while burial of these items took place. A similar possibility of exposure may have occurred in 1956 during the placement of eight foot deep concrete sidewalls around the trenches, one foot thick reinforced concrete slab over the top of the trenches, and the two foot thick cap of clay soil covering the

slab. An unknown number of employees/workers took part in these operations. These workers could have potentially contacted contaminated waste, soil and/or breathed contaminated air. Potential for contact with site contaminants currently is minimal. Potential for future contact depends on the integrity of the concrete enclosure and the vegetated clay soil cover material. The site is completely unrestricted, but is covered by two feet of clay soil and vegetated with a thick cover of grass. Within a 4-mile radius of the Plot M site the population is calculated to be approximately 28,220 persons. The nearest occupied residential dwelling to the site is located approximately 4780 feet north of the northern site perimeter.

There are no schools or day care facilities on-site or within 200 feet of contaminated areas. Nearby population within one mile of Plot M has been calculated to be 5 and is presented below.

Nearby population within one mile of the site

Distance	Population
On-site	0
0 - 1/4 mile	0
1/4 - 1/2 mile	0
1/2 - 1 mile	5

The population was calculated using USGS topographic maps for the area surrounding the site and 2.73 people per household in Du Page County, as established by the U.S. Census Bureau (2000).

5.4 AIR ROUTE

During the April 8 - 10 2003 Combined Assessment there were no formal air samples collected. A Foxboro Toxic Vapor Analyzer (TVA) and hand held radiation detectors were utilized to screen ambient air around the site, air in the breathing zone at each sample point, and the sample as it was taken. Each detector was also used during operation of the Geoprobe to screen the breathing zone and sample cores as the core sleeves were opened. The detectors did not detect any levels of contaminants, either TCL or radiological, above background. There are no records, reports or complaints on file regarding air releases from the site. However, wind-borne and radiological emissions may have been generated by waste handling procedures such as dumping of radioactive waste into the open trenches and leaving the trenches uncovered. However, no information exists regarding the handling of waste once placed into the trenches. If left open, the potential existed for particulates to be carried off site by wind-borne transport and radioactive emissions to occur. If the trenches were immediately covered, exposure to wind action would not have been a factor and any particulate transfer and radioactive emissions would have been negligible. The major potential source of wind-borne contaminants and radioactive emissions was removed in 1956 with the construction of the eight foot deep walls surrounding the trenches and the one foot thick concrete cap with two feet of soil covering the trenches. Although no TCL contaminants were detected in on site soil and only one semi-volatile constituent detected in stream sediments, a potential for contaminated particulates to be carried off-site remains. Low levels of hydrogen-3 have periodically been detected, during the Argonne monitoring program, in surface water of the intermittent stream adjacent to the Plot M site. During dry periods of the year, when the stream no longer flows and the stream bed becomes dry, the potential exists for wind-blown particulates to be carried from this location.

Within a 4-mile radius of the facility the population is calculated to be approximately 28,220 persons. The nearest individual (barge to rail transfer company employees) and regularly occupied building (the barge to rail transfer company building) is located approximately 1720 feet north of the Plot M site. The approximate number of individuals potentially exposed to air-borne particulates are listed below. The potential for wind blown particulates to carry contaminants off-site is possible since these contaminants have been found in the top six inches of sediment on-site. Sensitive environments within four miles of Plot M consist of wetlands described previously in this report.

Individuals potentially exposed to air-borne contaminants

Distance	Population
On-site	0
0 - 1/4 mile	0
1/4 - 1/2 mile	0
1/2 - 1 mile	5
1 - 2 miles	1200
2 - 3 miles	6443
3 - 4 miles	20,571

The population was calculated using USGS topographic maps for the area surrounding the facility and 2.73 people per household in Du Page County and 2.68 people per household in Cook County, as established by the U.S. Census Bureau (2000).

6.0 ADDITIONAL RISK-BASED OBJECTIVES

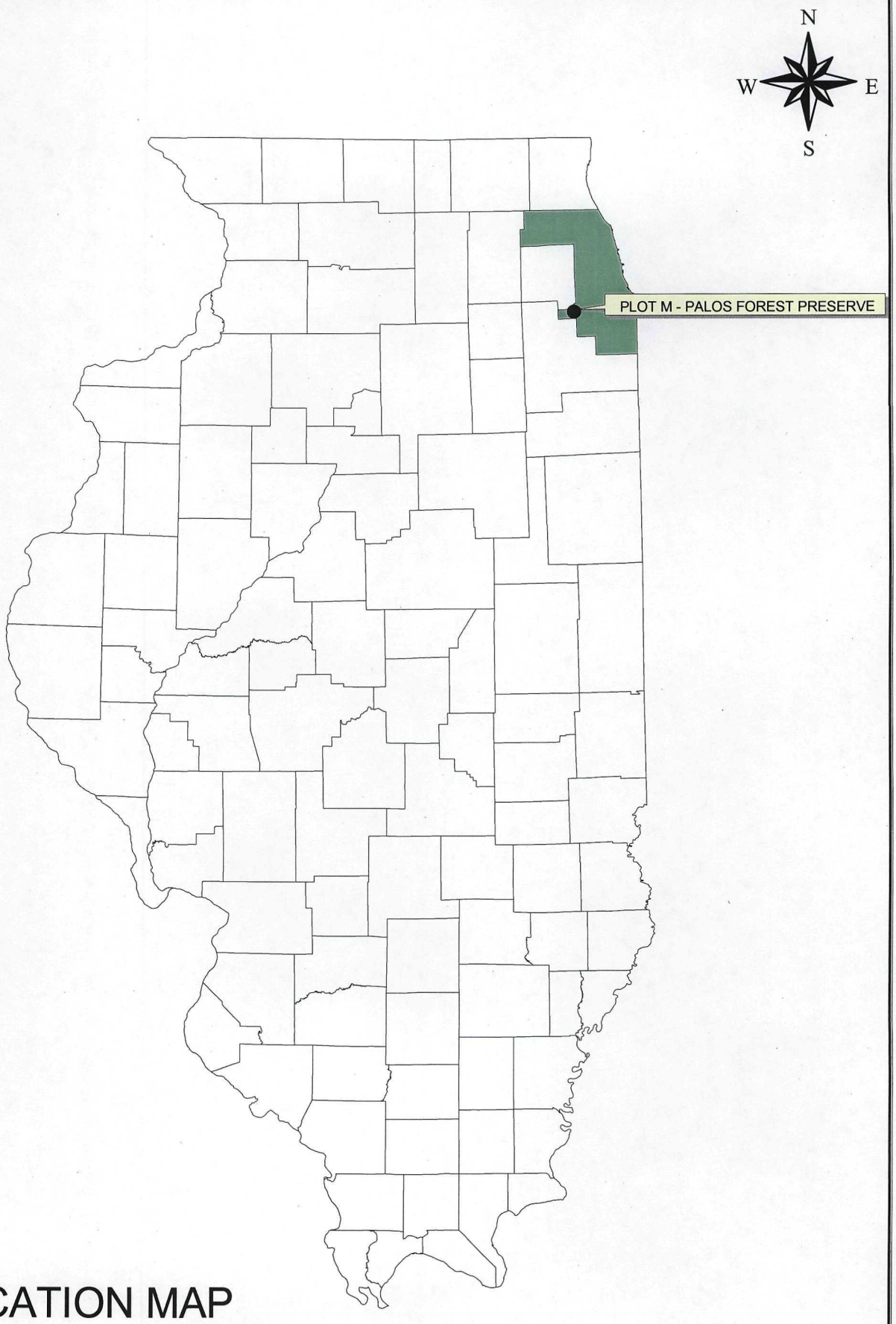
The sediment samples collected during the April 8 – 10, 2003 investigation have been compared to ecological benchmarks to help determine whether site activities have impacted the surface water pathway. Two sources of benchmarks were used for this comparison: Ontario sediment quality guidelines and USEPA ecotox thresholds. Ontario sediment quality guidelines are non-regulatory ecological benchmark values that serve as indicators of potential aquatic impacts. Levels of contaminants below Ontario benchmarks indicate a level of pollution which has no effect on the majority of the sediment dwelling organisms. Contaminants for which no Ontario benchmarks are available are compared to USEPA ecotox thresholds. Ecotox thresholds are ecological benchmarks above which there is sufficient concern regarding adverse ecological effects to warrant further site investigation. Ecotox thresholds are to be used for screening purposes and are not regulatory criteria, site-specific cleanup standards or remediation goals.

Analytical results of sediment samples X201 – X214 (Table 2) indicate that a few detectable volatile constituents were present in quantitative and estimated values in some of these samples (X202, and X206 – X213). None of the volatile constituent values exceeded Ontario sediment guidelines or USEPA Ecotox thresholds. Various quantitative and estimated concentrations of semi-volatile constituents were present in five (X201, X202, X207, X208 and X210) of the sediment samples. One constituent in sample X201 exceeded indicated background values and Ontario sediment guidelines or USEPA Ecotox thresholds. Two sediment samples (X201 & X202) contained three pesticide/PCB constituents in quantitative concentrations. All three of the constituents exceed indicated background values and Ontario sediment guidelines or USEPA Ecotox thresholds. Numerous inorganic analytes were detected in all sediment samples

in quantitative and estimated values. All of these samples contain at least one or more constituent in excess of Ontario sediment guidelines.

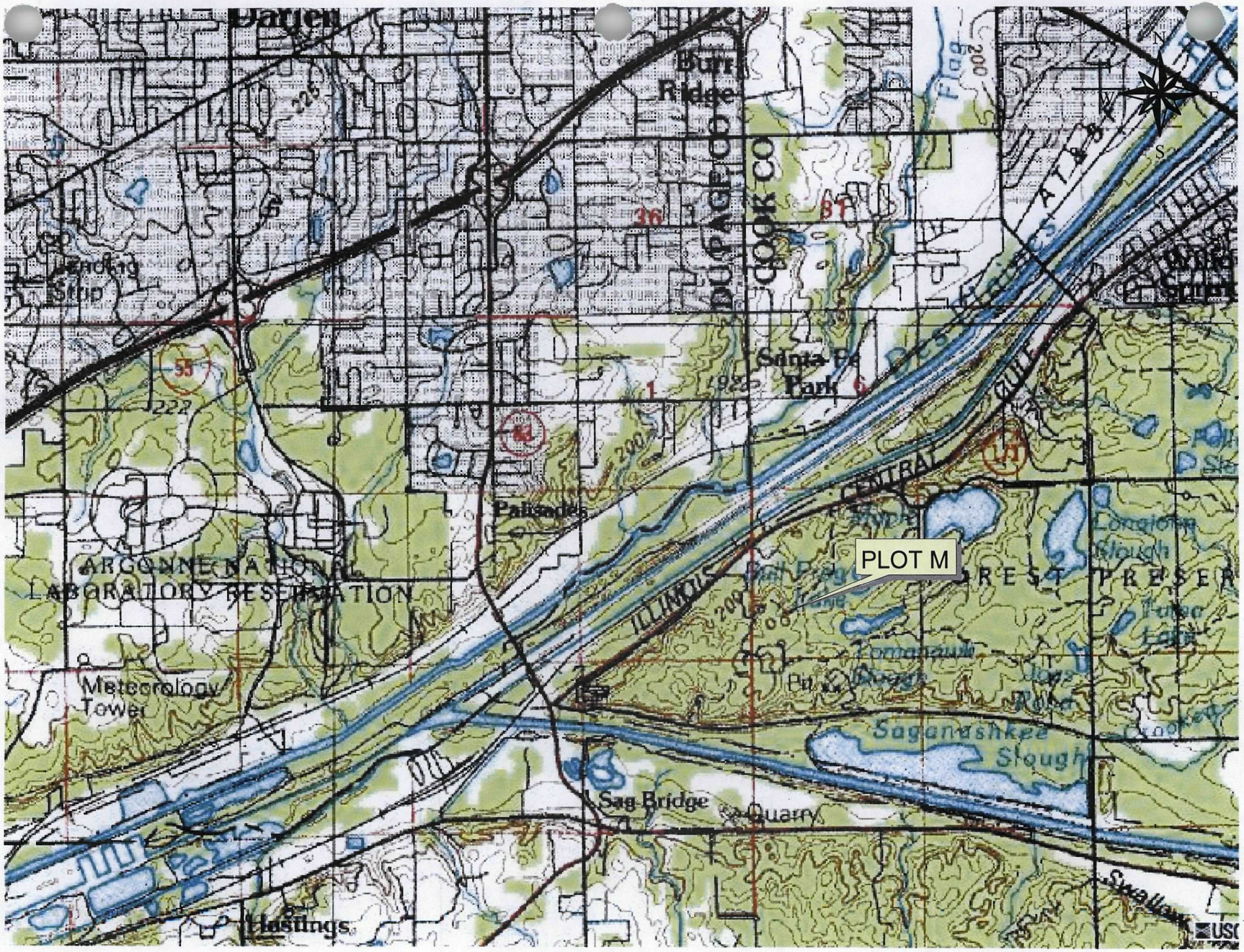
The soil samples collected during the April 8– 10, 2003 investigation have been compared to USEPA Removal Action Levels (RAL's) and the Superfund Chemical Data Matrix (SCDM) benchmarks to help determine whether site activities have impacted the soil exposure pathway and to evaluate the need for a possible future action at the facility. Analytical results of all soil samples indicate that all concentrations detected are below associated RAL's and SCDM benchmarks.

7.0 FIGURES AND TABLES



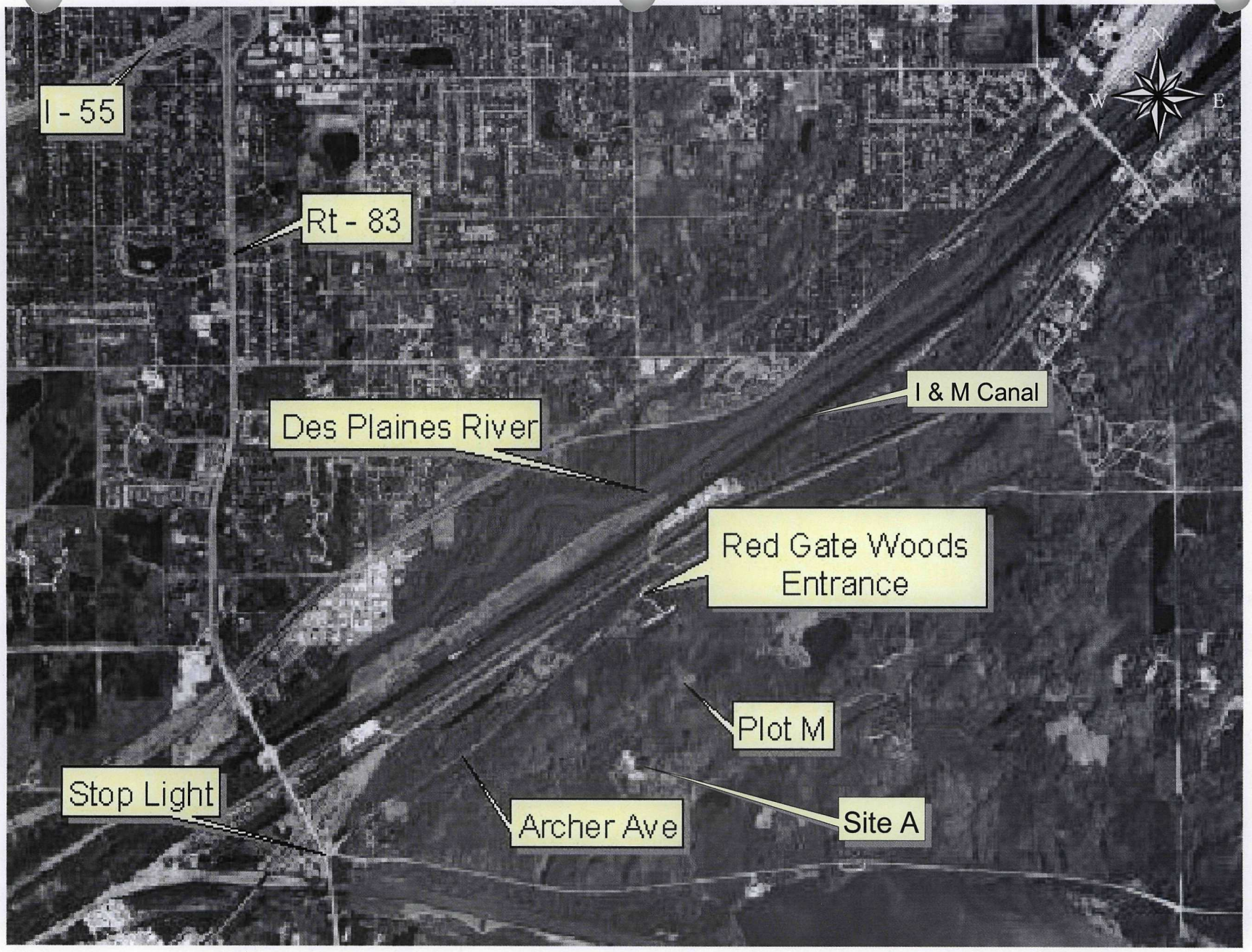
SITE LOCATION MAP

Figure 1



PLOT M TOPOGRAPHIC MAP

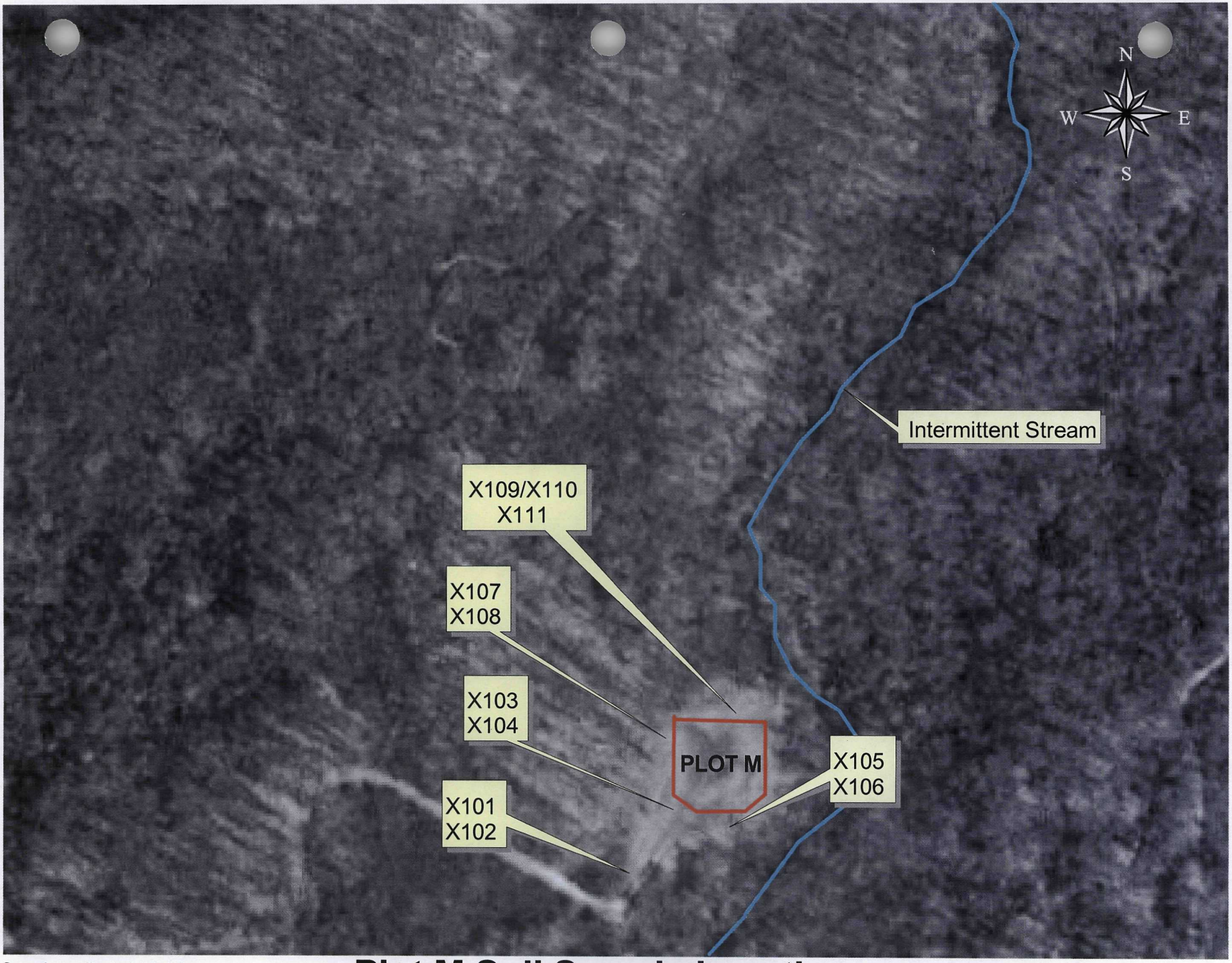
Figure 2



1997

PLOT M SITE AREA MAP

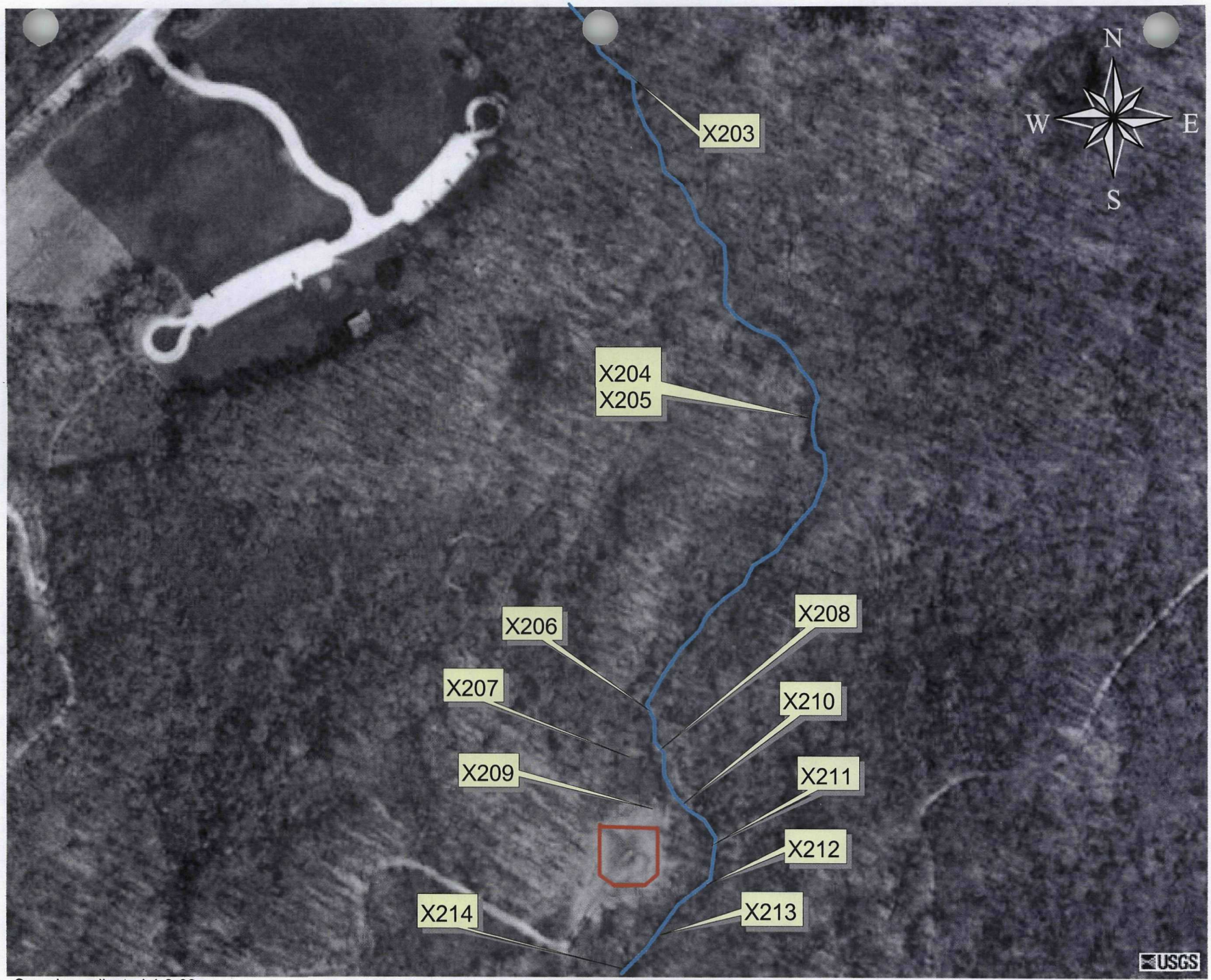
Figure 3



Samples collected 4-9-03

Plot M Soil Sample Locations

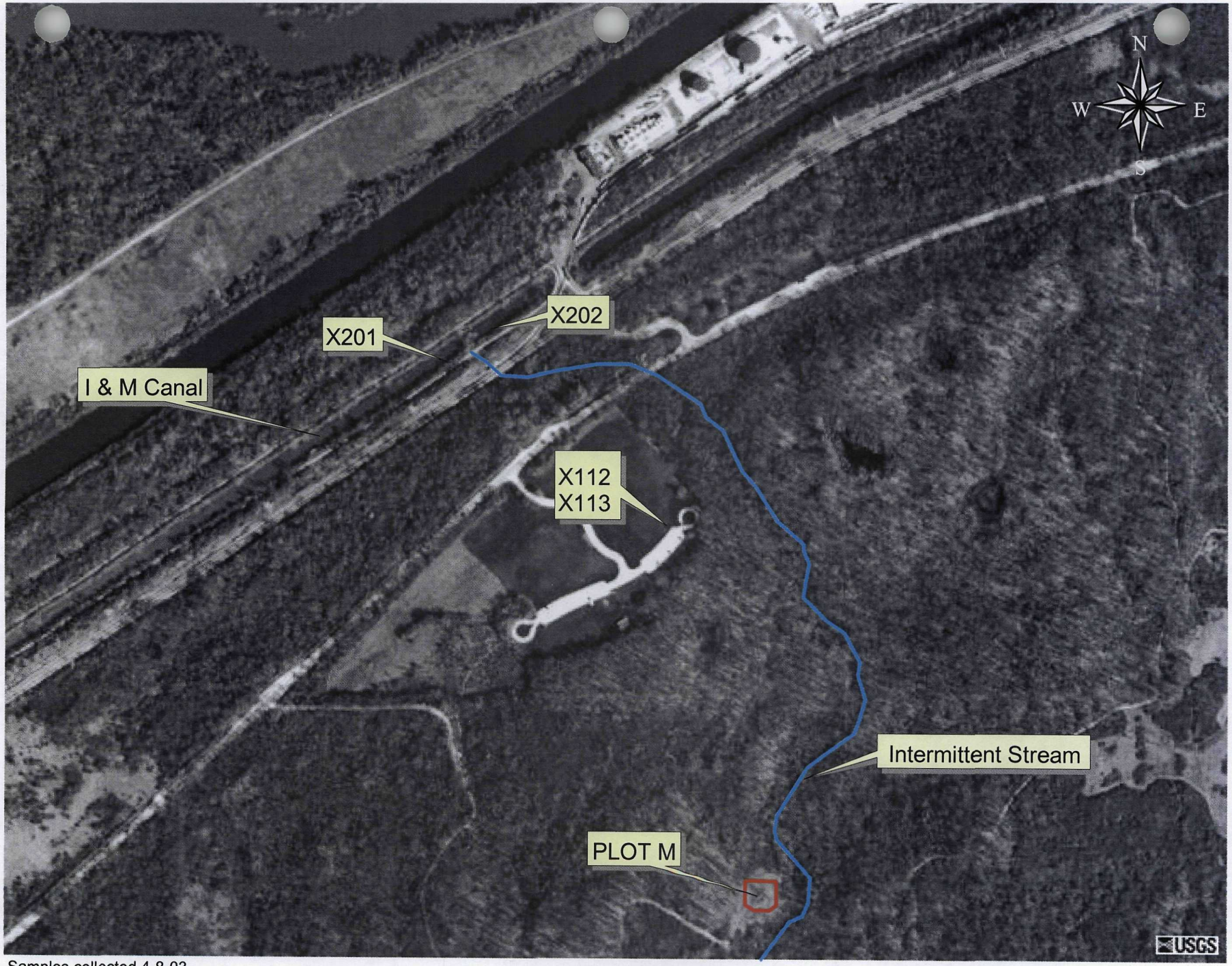
Figure 4



Samples collected 4-8-03

Plot M Sediment Sample Locations

Figure 5

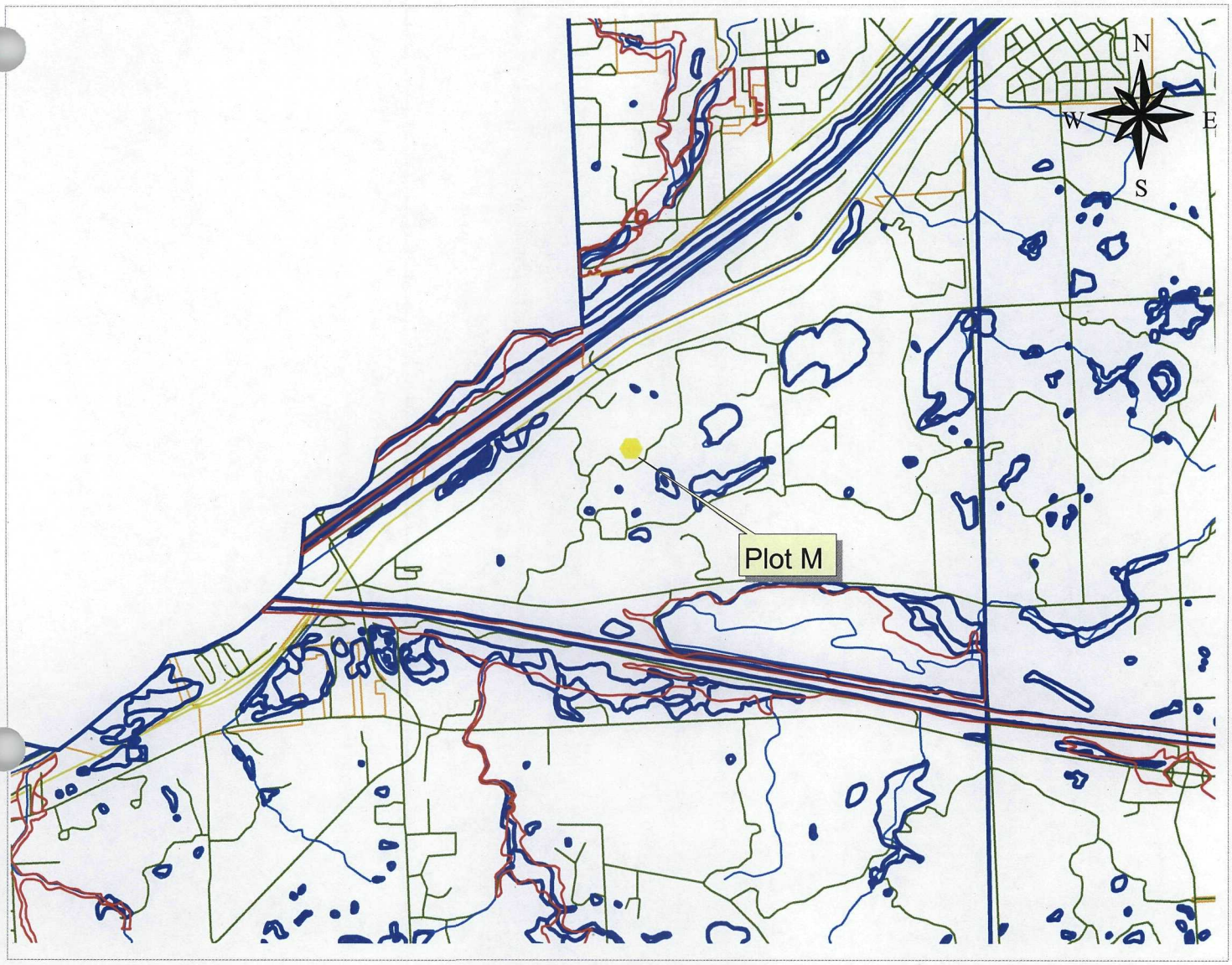


Samples collected 4-8-03

Plot M Soil & Sediment Sample Locations

Figure 6

Non Responsive



Plot M - Palos Forest Preserve
Palos Hills, Illinois

WETLAND LOCATION MAP

Figure 8

Floodzones
Wetlands
Streams
Roads
Rail Roads
Municipal Boundary
Cook Co. Boundary

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 1

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0015

Site : ARGONNE PLOT M

Lab. : CEIMIC

Sample Number :	Shallow	Deep	USEPA	E0022		E0023		E0024		E0025		E0015		E0016		E0017		E0018		E0019		E0020		E0021		E0026		E0027	
Sampling Location :	**Background**	**Background**	Removal	X101		X102		X103		X104		X105		X106		X107		X108		X109		X110 (Dup.)		X111		X112		X113	
Matrix :	(X101)	(X102)	Action	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Sample Depth			Levels	4'-5.5'		14.5'-16'		4'-5.5'		15'-16'		4'-5'		15'-16'		4'-5.5'		15'-17'		4'-6'		4'-6'		14'-16'		4'-5.5'		14.5'-16'	
Units :	ug/Kg	ug/Kg	ug/kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgnd*	3X Bkgnd*		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003	
Time Sampled :	if non-"J"	if non-"J"		14:45		14:45		13:55		13:55		12:50		12:50		09:50		09:50		11:15		11:15		11:15		16:30		16:30	
%Moisture :	or	or		13		9		17		13		16		11		20		11		20		20		14		16		13	
pH :	10X Bkgnd	10X Bkgnd		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0	
Dilution Factor :	if "J"	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Volatile Compound				Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
DICHLORODIFLUOROMETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CHLOROMETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
VINYL CHLORIDE			90000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
BROMOMETHANE				10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	11	UJ	10	UJ	10	UJ	10	UJ	10	UJ	11	U	10	U
CHLOROETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
TRICHLOROFLUOROMETHANE	40	40		4	J	4	J	1	J	6	J	1	J	2	J	1	J	6	J	1	J	1	J	6	J	11	U	7	J
1,1-DICHLOROETHENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	UJ	10	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
ACETONE	60	30		6	J	3	J	19		2	J	10		2	J	7	J	2	J	15		13		4	J	19		4	J
CARBON DISULFIDE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
METHYL ACETATE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
METHYLENE CHLORIDE				10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	11	UJ	10	UJ	10	UJ	10	UJ	10	UJ	11	UJ	10	UJ
TRANS-1,2-DICHLOROETHENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
METHYL TERT-BUTYL ETHER				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,1-DICHLOROETHANE			78000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CIS-1,2-DICHLOROETHENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
2-BUTANONE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CHLOROFORM				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,1,1-TRICHLOROETHANE			7000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CYCLOHEXANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CARBON TETRACHLORIDE			550000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
BENZENE			5900000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2-DICHLOROETHANE			1900000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
TRICHLOROETHENE	20			2	J	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
METHYLCYCLOHEXANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2-DICHLOROPROPANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
BROMODICHLOROMETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CIS-1,3-DICHLOROPROPENE			230000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
4-METHYL-2-PENTANONE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
TOLUENE	40	40	16000000	4	J	4	J	10	U	4	J	10	U	3	J	11	U	4	J	10	U	10	U	5	J	11	U	3	J
TRANS-1,3-DICHLOROPROPENE			230000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,1,2-TRICHLOROETHANE			3000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
TETRACHLOROETHENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
2-HEXANONE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	UJ	10	UJ
DIBROMOCHLOROMETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2-DIBROMOETHANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
CHLOROBENZENE			16000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
ETHYLBENZENE			78000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
XYLENES (TOTAL)				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
STYRENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
BROMOFORM			16000000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
ISOPROPYLBENZENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,1,2,2-TETRACHLOROETHANE			850000	10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,3-DICHLOROBENZENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,4-DICHLOROBENZENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2-DICHLOROBENZENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2-DIBROMO-3-CHLOROPROPANE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U
1,2,4-TRICHLOROBENZENE				10	U	10	U	10	U	10	U	10	U	10	U	11	U	10	U	10	U	10	U	10	U	11	U	10	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 1 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0015
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Shallow	Deep	USEPA	E0022		E0023		E0024		E0025		E0015		E0016		E0017		E0018		E0019		E0020		E0021		E0026		E0027	
Sampling Location :	Background	Background	Removal	X101		X102		X103		X104		X105		X106		X107		X108		X109		X110		X111		X112		X113	
Matrix :	(X101)	(X102)	Action	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Sample Depth			Levels	4'-5.5'		14.5'-16'		4'-5.5'		15'-16'		4'-5'		15'-16'		4'-5.5'		15'-17'		4'-6'		4'-6'		14'-16'		4'-5.5'		14.5'-16'	
Units :	ug/Kg	ug/Kg	ug/kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgnd*	3X Bkgnd*		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003	
Time Sampled :	if non-"J"	if non-"J"		14:45		14:45		13:55		13:55		12:50		12:50		09:50		09:50		11:15		11:15		11:15		16:30		16:30	
%Moisture :	or	or		11		13		22		13		20		11		17		11		19		19		15		14		14	
pH :	10X Bkgnd	10X Bkgnd		8.7		7.8		5.5		8.8		7.6		8.5		7.2		8.1		7.0		6.9		8.9		8.2		8.6	
Dilution Factor :	if "J"	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Semivolatile Compound				Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
BENZALDEHYDE	Background	Background		370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
PHENOL	at	at		370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BIS-(2-CHLOROETHYL)ETHER	Detection	Detection	150000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-CHLOROPHENOL	Limits	Limits	3900000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-METHYLPHENOL				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,2'-OXYBIS(1- CHLOROPROPANE)				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
ACETOPHENONE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
4-METHYLPHENOL				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
N-NITROSO-DI-N PROPYLAMINE			24000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
HEXACHLOROETHANE			780000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
NITROBENZENE			390000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
ISOPHORONE			42000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-NITROPHENOL				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4-DIMETHYLPHENOL			16000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BIS(2-CHLOROETHOXY)METHANE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4-DICHLOROPHENOL			2300000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
NAPHTHALENE			500000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
4-CHLOROANILINE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
HEXACHLOROBUTADIENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
CAPROLACTAM				370	UJ	380	UJ	420	UJ	370	UJ	410	UJ	370	UJ	400	UJ	360	UJ	400	UJ	400	UJ	380	UJ	380	UJ	380	U
4-CHLORO-3-METHYLPHENOL				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-METHYLNAPHTHALENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
HEXACHLOROCYCLO-PENTADIENE			5500000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4,6-TRICHLOROPHENOL			*15000000*	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4,5-TRICHLOROPHENOL				920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
1,1'-BIPHENYL				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-CHLORONAPHTHALENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2-NITROANILINE				920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
DIMETHYLPHTHALATE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,6-DINITROTOLUENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
ACENAPHTHYLENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
3-NITROANILINE				920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
ACENAPHTHENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4-DINITROPHENOL			1600000	920	UJ	940	UJ	1100	UJ	940	UJ	1000	UJ	930	UJ	1000	UJ	920	UJ	1000	UJ	1000	UJ	960	UJ	950	UJ	950	U
4-NITROPHENOL			48000000	920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
DIBENZOFURAN				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
2,4-DINITROTOLUENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
DIETHYLPHTHALATE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
FLUORENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
4-CHLOROPHENYL-PHENYL ETHER				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
4-NITROANILINE				920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	UJ
4,6-DINITRO-2-METHYLPHENOL				920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
N-NITROSO DIPHENYLAMINE			35000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
4-BROMOPHENYL-PHENYLETHER				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
HEXACHLOROBENZENE			110000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
ATRAZINE				370	UJ	380	UJ	420	UJ	370	UJ	410	UJ	370	UJ	400	UJ	360	UJ	400	UJ	400	UJ	380	UJ	380	UJ	380	UJ
PENTACHLOROPHENOL			100000	920	U	940	U	1100	U	940	U	1000	U	930	U	1000	U	920	U	1000	U	1000	U	960	U	950	U	950	U
PHENANTHRENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
ANTHRACENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
CARBAZOLE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
DI-N-BUTYLPHTHALATE			78000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
FLUORANTHENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
PYRENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BUTYLBENZYLPHTHALATE			1600000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
3,3'-DICHLOROBENZIDINE			380000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BENZO(A)ANTHRACENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
CHRYSENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BIS(2-ETHYLHEXYL)PHTHALATE			12000000	370	UJ	810	U	420	UJ	370	UJ	410	UJ	370	U	400	UJ	360	UJ	400	UJ	400	UJ	1700	U	380	UJ	380	UJ
DI-N-OCTYLPHTHALATE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BENZO(B)FLUORANTHENE				370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BENZO(K)FLUORANTHENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BENZO(A)PYRENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
INDENO(1,2,3-CD)-PYRENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
DIBENZO(A,H)-ANTHRACENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U
BENZO(G,H,I)PERYLENE			1000000	370	U	380	U	420	U	370	U	410	U	370	U	400	U	360	U	400	U	400	U	380	U	380	U	380	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", *any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.*

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.
- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 1 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0015
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Shallow	Deep	USEPA	E0022		E0023		E0024		E0025		E0015		E0016		E0017		E0018		E0019		E0020		E0021		E0026		E0027	
Sampling Location :	**Background**	**Background**	Removal	X101		X102		X103		X104		X105		X106		X107		X108		X109		X110		X111		X112		X113	
Matrix :	(X101)	(X102)	Action	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Sample Depth			Levels	4'-5.5'		14.5'-16'		4'-5.5'		15'-16'		4'-5'		15'-16'		4'-5.5'		15'-17'		4'-6'		4'-6'		14'-16'		4'-5.5'		14.5'-16'	
Units :	ug/Kg	ug/Kg	ug/kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgnd*	3X Bkgnd*		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003	
Time Sampled :	if non-"J"	if non-"J"		14:45		14:45		13:55		13:55		12:50		12:50		09:50		09:50		11:15		11:15		11:15		16:30		16:30	
%Moisture :	or	or		11		13		22		14		20		11		18		11		19		19		15		14		14	
pH :	10X Bkgnd	10X Bkgnd		8.7		7.8		5.5		8.8		7.6		8.5		7.2		8.1		7.0		6.9		8.9		8.2		8.6	
Dilution Factor :	if "J"	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Pesticide/PCB Compound				Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALPHA-BHC	Background	Background		1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
BETA-BHC	at	at		1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
DELTA-BHC	Detection	Detection		1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
GAMMA-BHC (LINDANE)	Limits	Limits		1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
HEPTACHLOR			38000	1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
ALDRIN			10000	1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
HEPTACHLOR EPOXIDE			23000	1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
ENDOSU1FAN I			39000	1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
DIELDRIN			11000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
4,4'-DDE			500000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
ENDRIN			230000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
ENDOSULFAN II			39000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
4,4'-DDD			710000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
ENDOSULFAN SULFATE				3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
4,4'-DDT			390000	3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
METHOXYCHLOR				19	U	19	U	22	U	20	U	21	U	19	U	21	U	19	U	21	U	21	U	20	U	20	U	20	U
ENDRIN KETONE				3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
ENDRIN ALDEHYDE				3.7	U	3.7	U	4.2	U	3.8	U	4.1	U	3.7	U	4.0	U	3.7	U	4.0	U	4.0	U	3.9	U	3.8	U	3.8	U
ALPHA-CHLORDANE				1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
GAMMA-CHLORDANE				1.9	U	1.9	U	2.2	U	2.0	U	2.1	U	1.9	U	2.1	U	1.9	U	2.1	U	2.1	U	2.0	U	2.0	U	2.0	U
TOXAPHENE			150000	190	U	190	U	220	U	200	U	210	U	190	U	210	U	190	U	210	U	210	U	200	U	200	U	200	U
AROCLOR-1016				37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U
AROCLOR-1221			22000	74	U	76	U	85	U	78	U	82	U	75	U	81	U	75	U	82	U	82	U	78	U	77	U	78	U
AROCLOR-1232				37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U
AROCLOR-1242			22000	37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U
AROCLOR-1248			22000	37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U
AROCLOR-1254			22000	37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U
AROCLOR-1260			22000	37	U	37	U	42	U	38	U	41	U	37	U	40	U	37	U	40	U	40	U	39	U	38	U	38	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 1 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : ME0015

Site : ARGONNE PLOT M

Lab. : BONNER

Sample Number :	Shallow	Deep	USEPA	ME0022		ME0023		ME0024		ME0025		ME0015		ME0016		ME0017		ME0018		ME0019		ME0020		ME0021		ME0026		ME0027	
Sampling Location :	Background	Background	Removal	X101		X102		X103		X104		X105		X106		X107		X108		X109		X110		X111		X112		X113	
Matrix :	(X101)	(X102)	Action	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Sample Depth			Levels	4'-5.5'		14.5'-16'		4'-5.5'		15'-16'		4'-5'		15'-16'		4'-5.5'		15'-17'		4'-6'		4'-6'		14'-16'		4'-5.5'		14.5'-16'	
Units :	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Date Sampled :	3X Bkgnd*	3X Bkgnd*		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003		04/09/2003	
Time Sampled :	if non-"J"	if non-"J"		14:45		14:45		13:55		13:55		12:50		12:50		09:50		09:50		11:15		11:15		11:15		16:30		16:30	
%Solids :	or	or		88.0		88.3		79.1		87.7		83.8		86.4		81.0		90.1		82.8		83.7		88.4		78.4		87.9	
pH	10X Bkgnd	10X Bkgnd																											
Dilution Factor :	if "J"	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
ANALYTE				Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	41700	23430		13900		7810		28000		12400		17600		10200		18400		5840		15300		16400		9900		16400		7270	
ANTIMONY	7.3	8.7	310	0.73	J	0.87	J	0.81	J	0.93	J	14.0	U	0.79	J	14.4	U	0.63	J	0.55	J	13.7	U	12.3	U	14.6	U	0.63	J
ARSENIC	25.5	15.9	200	8.5		5.1		11.6		9.4		13.8		10.0		10.7		8.0		16.6		13.3		9.3		21.1		7.5	
BARIUM	199.5	86.4		66.5		28.8		84.5		48.7		64.7		38.6		81.5		15.0		77.6		79.0		33.5		86.8		21.6	
BERYLLIUM	2.28	1.38	40	0.76		0.46		0.96		0.64		1.1		0.57		0.90		0.36		0.83		0.90		0.52		0.89		0.39	
CADMIUM	1.38	1.59	25	0.46		0.53		0.50		0.60		0.46		0.67		0.34		0.54		0.73		0.65		0.60		0.75		0.53	
CALCIUM	157500	169200		52500		56400		1620		61300		1780		74400		1820		67500		21300		19500		72400		2880		91800	
CHROMIUM	66.3	39	400	22.1		13.0		33.4		19.4		27.2		16.9		26.6		10.9		23.4		25.1		15.7		23.7		12.0	
COBALT	39.9	25.2		13.3		8.4		10.0		11.5		26.4		11.3		25.9		7.6		15.8		15.4		10.4		12.1		7.9	
COPPER	75.3	82.2	5000	26.1		27.4		34.7		25.7		39.5		27.7		25.9		28.3		37.8		37.8		27.3		48.4		28.2	
IRON	67800	47100		22600		15700		35400		20900		30400		20400		27100		17800		30500		28300		19500		36100		16100	
LEAD	51.9	47.4	1000	17.3		15.8		24.2		14.4		28.7		16.5		31.3		17.6		24.0		24.0		13.8		29.7		11.8	
MAGNESIUM	72600	97800		24200		32600		6680		31700		5830		31000		5000		39300		16500		15500		40500		4050		51300	
MANGANESE	1272	1554		424		518		249		428		556		451		1260		479		512		489		430		1020		443	
MERCURY	0.15	0.21	1600	0.050		0.070		0.080		0.11	U	0.050		0.12	U	0.070		0.030		0.060		0.060		0.050		0.070		0.11	U
NICKEL	103.8	66	1600	34.6		22.0		29.6		27.2		42.9		27.1		24.5		19.0		49.6		43.6		25.4		37.5		18.2	
POTASSIUM	11970	7980		3990		2660		3790		4450		3340		3350		2620		2260		3110		3490		3490		2740		2590	
SELENIUM			2300	8.0	U	7.3	U	0.99		7.8	U	8.2	U	8.0	U	8.4	U	7.0	U	7.6	U	8.0	U	7.2	U	8.5	U	7.4	U
SILVER			2300	2.3	U	2.1	U	2.1	U	2.2	U	2.3	U	2.3	U	0.10	J	2.0	U	2.2	U	2.3	U	2.1	U	2.4	U	2.1	U
SODIUM	492	507		164		169		99.6		209		105		154		84.1		143		120		126		181		210		247	
THALLIUM	5.4	5.1	55	1.8		1.7		1.5		2.1		2.7		2.0		3.4		2.3		2.8		2.7		1.6		3.2		1.8	
VANADIUM	71.1	51.3		23.7		17.1		43.3		24.1		29.9		18.9		34.3		12.9		26.7		28.1		20.2		33.9		15.2	
ZINC	182.1	229.5	160000	60.7		76.5		76.0		58.5		87.5		70.6		60.8		83.1		82.7		82.4		62.4		136		50.7	
CYANIDE	0.18	0.12	350	0.060		0.040		0.040		0.050		0.070		0.080		0.14		0.030		0.020		0.050		0.060		0.080		0.060	

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

\- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

\- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

Values highlighted in YELLOW and bordered in RED are in excess of USEPA Removal Action Levels.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 1a

Radiological Soil Data

Analytical Results (Qualified Data)

Tracking # ARS031148

Site : ARGONNE PLOT M

Lab. : American Radiation Services, Inc.

Sample Number	GROSS ALPHA	GROSS GAMMA	URANIUM DECAY SERIES			THORIUM DECAY SERIES	TOTAL
			Ra-226	Bi-214	Pb-210	Ra-228	(Ra-226 + Ra-228)
	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
X102	7.79	41.94	4.065	1.230	0.841	0.607	4.7
X104	3.82	44.65	2.846	0.957	1.955	0.746	3.6
X106	165.52	44.95	2.156	0.843	2.033	0.710	2.9
X108	8.09	44.02	2.903	0.900	2.339	0.654	3.6
X111	6.31	48.02	3.161	1.002	2.219	0.770	3.9
X113	3.06	37.79	2.286	0.759	1.118	0.239	2.5

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 2

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0001
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Background	Ontario	E0002		E0003		E0004		E0005		E0006		E0007		E0008		E0009		E0010		E0011		E0012		E0013		E0014		E0001	
Sampling Location :	(X214)	Sediment	X201		X202		X203		X204		X205		X206		X207		X208		X209		X210		X211		X212		X213		X214 (Bkgrnd)	
Matrix :		Screening	Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Sample Depth		Benchmarks	2"-8"		2"-8"		0"-3"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"		0"-2"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"	
Units :	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgrnd		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003	
Time Sampled :	if non-"J"		13:20		13:40		14:30		14:50		14:50		15:40		15:50		16:05		16:20		16:35		16:55		17:10		17:20		17:35	
%Moisture :	or		60		60		25		27		32		27		39		22		47		25		30		27		31		20	
pH :	10X Bkgrnd		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0		7.0	
Dilution Factor :	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Volatile Compound			Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
DICHLORODIFLUOROMETHANE	Background		23	U	21	U	13	U	12	U	14	U	13	UJ	15	UJ	11	UJ	18	UJ	13	UJ	13	UJ	13	UJ	13	UJ	11	U
CHLOROMETHANE	at		23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
VINYL CHLORIDE	Detection		23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
BROMOMETHANE	Limits		23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CHLOROETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
TRICHLOROFLUOROMETHANE			23	U	21	U	13	U	12	U	14	U	3	J	3	J	2	J	3	J	2	J	3	J	5	J	2	J	11	U
1,1-DICHLOROETHENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
ACETONE			23	U	54		13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CARBON DISULFIDE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
METHYL ACETATE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
METHYLENE CHLORIDE			23	UJ	21	UJ	13	UJ	12	UJ	14	UJ	13	UJ	15	UJ	11	UJ	18	UJ	13	UJ	13	UJ	13	UJ	13	UJ	11	UJ
TRANS-1,2-DICHLOROETHENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
METHYL TERT-BUTYL ETHER			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,1-DICHLOROETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CIS-1,2-DICHLOROETHENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
2-BUTANONE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CHLOROFORM			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,1,1-TRICHLOROETHANE		170	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CYCLOHEXANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CARBON TETRACHLORIDE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
BENZENE		57	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2-DICHLOROETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
TRICHLOROETHENE		1600	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	UJ
METHYLCYCLOHEXANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2-DICHLOROPROPANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
BROMODICHLOROMETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CIS-1,3-DICHLOROPROPENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
4-METHYL-2-PENTANONE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
TOLUENE		670	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	UJ
TRANS-1,3-DICHLOROPROPENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,1,2-TRICHLOROETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
TETRACHLOROETHENE		530	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
2-HEXANONE			23	UJ	21	UJ	13	UJ	12	UJ	14	UJ	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	UJ
DIBROMOCHLOROMETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2-DIBROMOETHANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
CHLOROBENZENE		820	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	UJ
ETHYLBENZENE		3600	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
XYLENES (TOTAL)		25	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
STYRENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
BROMOFORM			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
ISOPROPYLBENZENE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,1,2,2-TETRACHLOROETHANE		940	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,3-DICHLOROBENZENE		1700	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,4-DICHLOROBENZENE		350	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2-DICHLOROBENZENE		340	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2-DIBROMO-3-CHLOROPROPANE			23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U
1,2,4-TRICHLOROBENZENE		9200	23	U	21	U	13	U	12	U	14	U	13	U	15	U	11	U	18	U	13	U	13	U	13	U	13	U	11	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

Values bordered in BLUE exceed Ontario Sediment Screening Benchmark levels.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 2 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0001
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Background	Ontario	E0002		E0003		E0004		E0005		E0006		E0007		E0008		E0009		E0010		E0011		E0012		E0013		E0014		E0001	
Sampling Location :	(X214)	Sediment	X201		X202		X203		X204		X205		X206		X207		X208		X209		X210		X211		X212		X213		X214 (Bkgrnd)	
Matrix :		Screening	Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Sample Depth		Benchmarks	2"-8"		2"-8"		0"-3"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"		0"-2"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"	
Units :	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgrnd		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003	
Time Sampled :	if non-"J"		13:20		13:40		14:30		14:50		14:50		15:40		15:50		16:05		16:20		16:35		16:55		17:10		17:20		17:35	
%Moisture :	or		54		46		29		27		28		30		33		17		40		17		26		29		28		33	
pH :	10X Bkgrnd		7.4		6.7		7.9		7.3		7.4		7.7		7.1		7.7		7.5		7.5		7.7		8.0		7.4		7.4	
Dilution Factor :	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Semivolatile Compound			Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
BENZALDEHYDE	Background		720	UJ	610	UJ	460	UJ	450	UJ	450	UJ	470	UJ	490	UJ	400	UJ	550	UJ	390	UJ	440	UJ	460	UJ	450	UJ	490	UJ
PHENOL	at		720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	UJ
BIS-(2-CHLOROETHYL)ETHER	Detection		720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2-CHLOROPHENOL	Limits		720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2-METHYLPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,2'-OXYBIS(1- CHLOROPROPANE)			720	U	610	U	460	UJ	450	UJ	450	UJ	470	UJ	490	UJ	400	UJ	550	UJ	390	UJ	440	UJ	460	UJ	450	UJ	490	UJ
ACETOPHENONE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-METHYLPHENOL			130	J	470	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
N-NITROSO-DI-N PROPYLAMINE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	UJ
HEXACHLOROETHANE		1000	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
NITROBENZENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
ISOPHORONE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2-NITROPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,4-DIMETHYLPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BIS(2-CHLOROETHOXY)METHANE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,4-DICHLOROPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
NAPHTHALENE		480	780		610	U	460	U	450	U	450	U	470	U	79	J	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-CHLOROANILINE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
HEXACHLOROBUTADIENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
CAPROLACTAM			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-CHLORO-3-METHYLPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	UJ
2-METHYLNAPHTHALENE			95	J	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
HEXACHLOROCYCLO-PENTADIENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,4,6-TRICHLOROPHENOL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,4,5-TRICHLOROPHENOL			1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
1,1'-BIPHENYL			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2-CHLORONAPHTHALENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2-NITROANILINE			1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
DIMETHYLPHTHALATE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,6-DINITROTOLUENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
ACENAPHTHYLENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
3-NITROANILINE			1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
ACENAPHTHENE		620	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	UJ
2,4-DINITROPHENOL			*1800*	*U*	*1500*	*U*	*1200*	*U*	*1100*	*U*	*1100*	*U*	*1200*	*U*	*1200*	*U*	*1000*	*U*	*1400*	*U*	*990*	*U*	*1100*	*U*	*1200*	*U*	*1100*	*U*	*1200*	*U*
4-NITROPHENOL			1800	U	1500	U	1200	UJ	1100	UJ	1100	UJ	1200	UJ	1200	UJ	1000	UJ	1400	UJ	990	UJ	1100	UJ	1200	UJ	1100	UJ	1200	UJ
DIBENZOFURAN		2000	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
2,4-DINITROTOLUENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
DIETHYLPHTHALATE		630	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
FLUORENE		540	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-CHLOROPHENYL-PHENYL ETHER			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-NITROANILINE			1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
4,6-DINITRO-2-METHYLPHENOL			1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
N-NITROSO DIPHENYLAMINE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
4-BROMOPHENYL-PHENYLETHER			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
HEXACHLOROBENZENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
ATRAZINE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
PENTACHLOROPHENOL		690	1800	U	1500	U	1200	U	1100	U	1100	U	1200	U	1200	U	1000	U	1400	U	990	U	1100	U	1200	U	1100	U	1200	U
PHENANTHRENE		850	720	U	62	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
ANTHRACENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
CARBAZOLE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
DI-N-BUTYLPHTHALATE		11000	720	U	610	U	460	U	450	U	450	U	470	U	490	U	120	J	550	U	390	U	440	U	460	U	450	U	490	U
FLUORANTHENE		2900	180	J	180	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
PYRENE		660	85	J	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	UJ
BUTYLBENZYLPHTHALATE		11000	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
3,3'-DICHLOROBENZIDINE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BENZO(A)ANTHRACENE			92	J	110	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
CHRYSENE			83	J	110	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BIS(2-ETHYLHEXYL)PHTHALATE			200	J	140	J	460	UJ	450	UJ	450	UJ	470	UJ	490	UJ	770		550	UJ	910		440	U	460	UJ	450	U	490	UJ
DI-N-OCTYLPHTHALATE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BENZO(B)FLUORANTHENE			110	J	130	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BENZO(K)FLUORANTHENE			720	U	81	J	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BENZO(A)PYRENE		430	720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
INDENO(1,2,3-CD)-PYRENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
DIBENZO(A,H)-ANTHRACENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U
BENZO(G,H,I)PERYLENE			720	U	610	U	460	U	450	U	450	U	470	U	490	U	400	U	550	U	390	U	440	U	460	U	450	U	490	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

Values bordered in BLUE exceed Ontario Sediment Screening Benchmark levels.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 2 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0001
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Background	Ontario	E0002		E0003		E0004		E0005		E0006		E0007		E0008		E0009		E0010		E0011		E0012		E0013		E0014		E0001	
Sampling Location :	(X207)	Sediment	X201		X202		X203		X204		X205		X206		X207		X208		X209		X210		X211		X212		X213		X214 (Bkgrnd)	
Matrix :		Screening	Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Sample Depth		Benchmarks	2"-8"		2"-8"		0"-3"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"		0"-2"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"	
Units :	ug/Kg	ug/Kg	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Date Sampled :	3X Bkgrnd		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003	
Time Sampled :	if non-"J"		13:20		13:40		14:30		14:50		14:50		15:40		15:50		16:05		16:20		16:35		16:55		17:10		17:20		17:35	
%Moisture :	or		54		46		29		27		28		30		33		17		40		17		26		29		28		33	
pH :	10X Bkgrnd		7.4		6.7		7.9		7.3		7.4		7.7		7.1		7.7		7.5		7.5		7.7		8.0		7.4		7.4	
Dilution Factor :	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Pesticide/PCB Compound			Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALPHA-BHC	Background	6	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
BETA-BHC	at	5	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
DELTA-BHC	Detection		3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
GAMMA-BHC (LINDANE)	Limits	3	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	UJ
HEPTACHLOR			3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
ALDRIN		2	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
HEPTACHLOR EPOXIDE			3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
ENDOSU1FAN I		2.9	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
DIELDRIN		2	7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
4,4'-DDE		5	160		77		4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
ENDRIN		3	7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
ENDOSULFAN II		14	7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
4,4'-DDD		8	32		28		4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
ENDOSULFAN SULFATE			7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
4,4'-DDT		7	21		18		4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
METHOXYCHLOR		19	37	U	31	U	24	U	23	U	24	U	24	U	25	U	20	U	28	U	20	U	23	U	24	U	23	U	25	U
ENDRIN KETONE			7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
ENDRIN ALDEHYDE			7.2	U	6.1	U	4.6	U	4.5	U	4.6	U	4.7	U	4.9	U	4.0	U	5.4	U	4.0	U	4.5	U	4.6	U	4.6	U	4.9	U
ALPHA-CHLORDANE		7	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
GAMMA-CHLORDANE		7	3.7	U	3.1	U	2.4	U	2.3	U	2.4	U	2.4	U	2.5	U	2.0	U	2.8	U	2.0	U	2.3	U	2.4	U	2.3	U	2.5	U
TOXAPHENE		28	370	U	310	U	240	U	230	U	240	U	240	U	250	U	200	U	280	U	200	U	230	U	240	U	230	U	250	U
AROCLOR-1016		7	72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U
AROCLOR-1221			150	U	120	U	93	U	91	U	93	U	95	U	99	U	80	U	110	U	80	U	91	U	93	U	92	U	99	U
AROCLOR-1232			72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U
AROCLOR-1242			72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U
AROCLOR-1248		30	72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U
AROCLOR-1254		60	72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U
AROCLOR-1260		5	72	U	61	U	46	U	45	U	46	U	47	U	49	U	40	U	54	U	40	U	45	U	46	U	46	U	49	U

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

\- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

\- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

Values bordered in BLUE exceed Ontario Sediment Screening Benchmark levels.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 2 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : ME0001
Site : ARGONNE PLOT M
Lab. : BONNER

Sample Number :	Background	Ontario	ME0002		ME0003		ME0004		ME0005		ME0006		ME0007		ME0008		ME0009		ME0010		ME0011		ME0012		ME0013		ME0014		ME0001	
Sampling Location :	(X214)	Sediment	X201		X202		X203		X204		X205		X206		X207		X208		X209		X210		X211		X212		X213		X214(Bkgrnd)	
Matrix :		Screening	Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
Sample Depth		Benchmarks	2"-8"		2"-8"		0"-3"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"		0"-2"		0"-3"		0"-3"		0"-3"		0"-3"		0"-4"	
Units :	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Date Sampled :	3X Bkgrnd		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003		04/08/2003	
Time Sampled :	if non-"J"		13:20		13:40		14:30		14:50		14:50		15:40		15:50		16:05		16:20		16:35		16:55		17:10		17:20		17:35	
%Solids :	or		54.7		52.1		68.8		71.8		69.1		72.9		60.1		74.3		54.4		75.3		67.5		71.5		71.0		68.4	
pH	10X Bkgrnd																													
Dilution Factor :	if "J"		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
ANALYTE			Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	33600		10100		13100		11200		8240		7600		8840		10400		7280		8930		7450		10000		8400		8810		11200	
ANTIMONY	46		2.4	J	2.7	J	3.4	J	5.1	J	2.9	J	2.8	J	3.4	J	4.4	J	2.8	J	3.7	J	2.9	J	3.8	J	3.3	J	4.6	J
ARSENIC	1470	6	18.5	J	28.9	J	13.2	J	15.5	J	9.8	J	13.4	J	13.9	J	25.8	J	7.9	J	18.8	J	15.9	J	15.9	J	15.8	J	147	J
BARIUM	522		61.7		80.8		96.4		134		136		104		121		83.4		68.3		196		156		82.7		133		174	
BERYLLIUM	2.58		0.61		0.76		0.66		0.78		0.69		0.63		0.77		0.60		0.60		0.69		0.75		0.65		0.88		0.86	
CADMIUM	8.6	0.6	1.4	J	6.4	J	0.080	J	1.3	R	1.1	R	0.14	J	0.070	J	1.0	R	0.070	J	0.15	J	0.15	J	1.2	R	1.2	R	0.86	R
CALCIUM	24330		57900		25200		13800		7600		7340		19700		7020		33700		10500		26300		17300		19200		4530		8110	
CHROMIUM	642	26	28.3	J	99.0	J	16.8	J	16.7	J	16.0	J	13.6	J	18.1	J	13.7	J	15.1	J	14.8	J	16.4	J	15.6	J	16.6	J	64.2	J
COBALT	86.1	50	7.4		10.0		16.4		22.1		14.9		20.3		23.0		16.2		10.5		27.7		27.4		20.2		27.6		28.7	
COPPER	87.6	16	29.5		49.7		20.5		25.3		16.1		20.5		22.4		22.2		22.6		22.6		23.7		19.8		20.4		29.2	
IRON	123900	20000	16700		21800		24100		33700		18900		22000		23800		31600		17200		30100		25000		12500		27400		41300	
LEAD	697	31	36.9	J	59.0	J	27.3	J	26.9	J	21.9	J	30.8	J	42.0	J	28.4	J	30.0	J	28.5	J	33.8	J	35.8	J	34.4	J	69.7	J
MAGNESIUM	17790		35200		16400		9840		4760		4730		12700		5470		21400		6780		16700		11000		11800		3280		5930	
MANGANESE	19100	460	329	J	396	J	1310	J	1740	J	1090	J	1630	J	1780	J	1330	J	441	J	3050	J	2180	J	1340	J	1930	J	1910	J
MERCURY	0.24	0.2	0.15		0.27		0.11		0.14	U	0.080		0.070		0.12		0.080		0.11		0.060		0.090		0.070		0.080		0.080	
NICKEL	110.4	16	23.4		38.5		28.6		29.9		21.5		25.2		25.9		22.2		21.0		38.6		35.0		26.0		28.1		36.8	
POTASSIUM	6870		3600		3790		2020		1540		1510		1700		1960		1870		1990		1950		2230		1820		1680		2290	
SELENIUM	60		1.1	J	1.9	J	1.0	J	2.0	J	1.3	J	1.8	J	0.99	J	2.3	J	0.75	R	1.5	J	2.2	J	1.4	J	2.2	J	6.0	R
SILVER	2.4	0.5	2.7	U	2.8	U	0.15	J	0.14	J	2.2	U	0.17	J	0.19	J	0.070	J	3.2	U	0.35	J	0.21	J	0.10	J	0.15	J	0.24	J
SODIUM	163.8		186		206		83.6		143		159		54.4		80.6		85.4		180		100		82.8		88.3		97.2		54.6	
THALLIUM	13.2		1.3		1.9		2.8		3.9		2.0		3.4		3.9		2.4		1.2		5.9		4.2		2.9		4.0		4.4	
VANADIUM	90		20.9		25.5		25.5		27.9		20.8		21.5		27.6		23.2		20.9		30.6		25.5		25.0		29.2		30.0	
ZINC	104	120	136	J	220	J	65.5	J	83.0	J	55.5	J	69.0	J	78.4	J	66.5	J	95.6	J	69.7	J	77.0	J	64.8	J	66.7	J	10.4	J
CYANIDE	0.3	0.1	0.10		0.18		0.080		0.17		0.15		0.19		0.22		0.21		0.13		0.080		0.26		0.14		0.17		0.10	

Values highlighted in YELLOW exceed indicated background levels.

* - If background value is "U" or "UJ", any sample value (including "J" sample values) greater than the background "U" or "UJ" value is considered to be in excess of the background and considered an observed release.

- If background value is "J", any sample value equal to or greater than 10 times background value is considered to be an observed release.

- If background value is non-"J", "U" or "UJ", any sample value equal to or greater than 3 times background value is considered to be an observed release.

Values bordered in BLUE exceed Ontario Sediment Screening Benchmark levels.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 3

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0028
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Class I	E0028		E0029		E0030		E0031		E0032		E0033	
Sampling Location :	Groundwater	G101		G102		G103		G104		FB		TB	
Matrix :	Benchmarks*	Water		Water		Water		Water		Water		Water	
Units :	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003	
Time Sampled :		09:15		09:00		10:30		10:30		10:40		10:40	
%Moisture :		N/A		N/A		N/A		N/A		N/A		N/A	
pH :													
Dilution Factor :		1.0		1.0		1.0		1.0		1.0		1.0	
Volatile Compound		Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
DICHLORODIFLUOROMETHANE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
CHLOROMETHANE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
VINYL CHLORIDE	2	10	U	10	U	10	U	10	U	10	U	10	U
BROMOMETHANE		10	U	10	U	10	U	10	U	10	U	10	U
CHLOROETHANE		10	U	10	U	10	U	10	U	10	U	10	U
TRICHLOROFLUOROMETHANE		10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	7	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
ACETONE	700	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
CARBON DISULFIDE	700	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
METHYL ACETATE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
METHYLENE CHLORIDE	5	10	U	10	U	10	U	10	U	10	U	10	U
TRANS-1,2-DICHLOROETHENE	100	10	U	10	U	10	U	10	U	10	U	10	U
METHYL TERT-BUTYL ETHER	70	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
1,1-DICHLOROETHANE	700	10	U	10	U	10	U	10	U	10	U	10	U
CIS-1,2-DICHLOROETHENE	70	10	U	10	U	10	U	10	U	10	U	10	U
2-BUTANONE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
CHLOROFORM	0.2	10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	200	10	U	10	U	10	U	10	U	10	U	10	U
CYCLOHEXANE		2	J	10	U	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	5	10	U	10	U	10	U	10	U	10	U	10	U
BENZENE	5	5	J	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	5	10	U	10	U	10	U	10	U	10	U	10	U
TRICHLOROETHENE	5	10	U	10	U	10	U	10	U	10	U	10	U
METHYLCYCLOHEXANE		10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	5	10	U	10	U	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	0.2	10	U	10	U	10	U	10	U	10	U	10	U
CIS-1,3-DICHLOROPROPENE	1	10	U	10	U	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
TOLUENE	1000	10	U	10	U	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	1	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	5	10	U	10	U	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	5	10	U	10	U	10	U	10	U	10	U	10	U
2-HEXANONE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
DIBROMOCHLOROMETHANE	140	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DIBROMOETHANE	0.05	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROBENZENE	100	10	U	10	U	10	U	10	U	10	U	10	U
ETHYLBENZENE	700	4	J	10	U	10	U	10	U	10	U	10	U
XYLENES (TOTAL)	10000	10	U	10	U	10	U	10	U	10	U	10	U
STYRENE	100	10	U	10	U	10	U	10	U	10	U	10	U
BROMOFORM	1	10	U	10	U	10	U	10	U	10	U	10	U
ISOPROPYLBENZENE		10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE		10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
1,3-DICHLOROBENZENE		10	U	10	U	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	75	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	600	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DIBROMO-3-CHLOROPROPANE	0.2	10	R	10	R	10	R	10	R	10	R	10	R
1,2,4-TRICHLOROBENZENE	70	10	U	10	U	10	U	10	U	10	U	10	U

Values highlighted in YELLOW exceed corresponding benchmark level.

* - If cell is empty, no benchmarks are available.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 3 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0028
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Class I	E0028		E0029		E0030		E0031		E0032	
Sampling Location :	Groundwater	G101		G102		G103		G104		FB	
Matrix :	Benchmarks*	Water		Water		Water		Water		Water	
Units :	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003	
Time Sampled :		09:15		09:00		10:30		10:30		10:40	
%Moisture :		N/A		N/A		N/A		N/A		N/A	
pH :											
Dilution Factor :		1.0		1.0		1.0		1.0		1.0	
Semivolatile Compound		Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
BENZALDEHYDE		10	U	10	U	10	U	10	U	10	U
PHENOL	100	10	U	10	U	10	U	10	U	10	U
BIS-(2-CHLOROETHYL)ETHER	10	10	U	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	35	10	U	10	U	10	U	10	U	10	U
2-METHYLPHENOL	350	10	U	10	U	10	U	10	U	10	U
2,2'-OXYBIS(1- CHLOROPROPANE)		10	U	10	U	10	U	10	U	10	U
ACETOPHENONE		10	U	10	U	10	U	10	U	10	U
4-METHYLPHENOL		10	U	10	U	10	U	10	U	10	U
N-NITROSO-DI-N PROPYLAMINE	1.8	10	U	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	7	10	U	10	U	10	U	10	U	10	U
NITROBENZENE	3.5	10	U	10	U	10	U	10	U	10	U
ISOPHORONE	1400	10	U	10	U	10	U	10	U	10	U
2-NITROPHENOL		10	U	10	U	10	U	10	U	10	U
2,4-DIMETHYLPHENOL	140	10	U	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE		10	U	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	21	10	U	10	U	10	U	10	U	10	U
NAPHTHALENE	140	10	U	10	U	10	U	10	U	10	U
4-CHLOROANILINE	28	10	U	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE		10	U	10	U	10	U	10	U	10	U
CAPROLACTAM		10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
4-CHLORO-3-METHYLPHENOL		10	U	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE		10	U	10	U	10	U	10	U	10	U
HEXACHLOROCYCLO-PENTADIENE	50	10	U	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	10	U	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	700	25	U	25	U	25	U	25	U	25	U
1,1'-BIPHENYL		10	U	10	U	10	U	10	U	10	U
2-CHLORONAPHTHALENE		10	U	10	U	10	U	10	U	10	U
2-NITROANILINE		25	U	25	U	25	U	25	U	25	U
DIMETHYLPHTHALATE		10	U	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	0.31	10	U	10	U	10	U	10	U	10	U
ACENAPHTHYLENE		10	U	10	U	10	U	10	U	10	U
3-NITROANILINE		25	U	25	U	25	U	25	U	25	U
ACENAPHTHENE	420	10	U	10	U	10	U	10	U	10	U
2,4-DINITROPHENOL	14	25	UJ	25	UJ	25	UJ	25	UJ	25	UJ
4-NITROPHENOL		25	U	25	U	25	U	25	UJ	25	U
DIBENZOFURAN		10	U	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	0.02	10	U	10	U	10	U	10	U	10	U
DIETHYLPHTHALATE	5600	10	U	10	U	10	U	10	U	10	U
FLUORENE	280	10	U	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYL ETHER		10	U	10	U	10	U	10	U	10	U
4-NITROANILINE		25	U	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL		25	U	25	U	25	U	25	U	25	U
N-NITROSO DIPHENYLAMINE	3.2	10	U	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYLETHER		10	U	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	0.06	10	U	10	U	10	U	10	U	10	U
ATRAZINE	3	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
PENTACHLOROPHENOL	1	25	U	25	U	25	U	25	U	25	U
PHENANTHRENE		10	U	10	U	10	U	10	U	10	U
ANTHRACENE	2100	10	U	10	U	10	U	10	U	10	U
CARBAZOLE		10	U	10	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	700	10	U	10	U	10	U	10	U	10	U
FLUORANTHENE	280	10	U	10	U	10	U	10	U	10	U
PYRENE	210	10	U	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	1400	10	U	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE		10	U	10	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	0.13	10	U	10	U	10	U	10	U	10	U
CHRYSENE	1.5	10	U	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	6	10	UJ	10	U	10	U	22	U	10	UJ
DI-N-OCTYLPHTHALATE	140	10	U	10	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	0.18	10	U	10	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	0.17	10	U	10	U	10	U	10	U	10	U
BENZO(A)PYRENE	0.2	10	U	10	U	10	U	10	U	10	U
INDENO(1,2,3-CD)-PYRENE	0.43	10	U	10	U	10	U	10	U	10	U
DIBENZO(A,H)-ANTHRACENE	0.3	10	U	10	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE		10	U	10	U	10	U	10	U	10	U

Values highlighted in YELLOW exceed corresponding benchmark level.

* - If cell is empty, no benchmarks are available.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 3 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : E0028
Site : ARGONNE PLOT M
Lab. : CEIMIC

Sample Number :	Class I	E0028		E0029		E0030		E0031		E0032	
Sampling Location :	Groundwater	G101**		G102**		G103		G104		FB	
Matrix :	Benchmarks*	Water		Water		Water		Water		Water	
Units :	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003	
Time Sampled :		09:15		09:00		10:30		10:30		10:40	
%Moisture :		N/A		N/A		N/A		N/A		N/A	
pH :											
Dilution Factor :		1.0		1.0		1.0		1.0		1.0	
Pesticide/PCB Compound		Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALPHA-BHC	0.11					0.050	U	0.050	U	0.050	U
BETA-BHC						0.050	U	0.050	U	0.050	U
DELTA-BHC						0.050	U	0.050	U	0.050	U
GAMMA-BHC (LINDANE)	0.2					0.050	U	0.050	UJ	0.050	U
HEPTACHLOR	0.4					0.050	U	0.050	UJ	0.050	U
ALDRIN	14					0.050	U	0.050	UJ	0.050	U
HEPTACHLOR EPOXIDE	0.2					0.050	U	0.050	U	0.050	U
ENDOSU1FAN I	42					0.050	U	0.050	U	0.050	U
DIELDRIN	9					0.10	U	0.10	UJ	0.10	U
4,4'-DDE	10					0.10	U	0.10	U	0.10	U
ENDRIN	2					0.10	U	0.10	U	0.10	U
ENDOSULFAN II						0.10	U	0.10	U	0.10	U
4,4'-DDD	14					0.10	U	0.10	U	0.10	U
ENDOSULFAN SULFATE						0.10	U	0.10	U	0.10	U
4,4'-DDT	6					0.10	U	0.10	U	0.10	U
METHOXYCHLOR	40					0.50	U	0.50	U	0.50	U
ENDRIN KETONE						0.10	U	0.10	U	0.10	U
ENDRIN ALDEHYDE						0.10	U	0.10	U	0.10	U
ALPHA-CHLORDANE	2					0.050	U	0.050	U	0.050	U
GAMMA-CHLORDANE	2					0.050	U	0.050	U	0.050	U
TOXAPHENE	3					5.0	U	5.0	U	5.0	U
AROCLOR-1016	0.5					1.0	U	1.0	U	1.0	U
AROCLOR-1221	0.5					2.0	U	2.0	U	2.0	U
AROCLOR-1232	0.5					1.0	U	1.0	U	1.0	U
AROCLOR-1242	0.5					1.0	U	1.0	U	1.0	U
AROCLOR-1248	0.5					1.0	U	1.0	U	1.0	U
AROCLOR-1254	0.5					1.0	U	1.0	U	1.0	U
AROCLOR-1260	0.5					1.0	U	1.0	U	1.0	U

Values highlighted in YELLOW exceed corresponding benchmark level.

* - If cell is empty, no benchmarks are available.

** - Insufficient amount of water recovered to analyze for this fraction.

PLOT M - PALOS FOREST PRESERVE

Palos Hills, Illinois

TABLE 3 (cont.)

Analytical Results (Qualified Data)

Case #: 31584 SDG : ME0030
Site : ARGONNE PLOT M
Lab. : BONNER

Sample Number :	Class I	E0028		E0029		ME0030		ME2AN3		ME0031		ME2AN4		ME0032		ME2AN5	
Sampling Location :	Groundwater	G101**		G102**		G103		G103-F***		G104		G104-F***		FB		FB-F***	
Matrix :	Benchmarks*	Water		Water		Water		Water		Water		Water		Water		Water	
Units :	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003		04/10/2003	
Time Sampled :		09:15		09:00		10:30		10:30		10:30		10:30		10:40		10:40	
%Solids :		N/A		N/A		N/A		0.0		N/A		0.0		N/A		0.0	
pH																	
Dilution Factor :		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
ANALYTE		Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM						200	U	200	U	200	U	200	U	200	U	200	U
ANTIMONY	6					60.0	U	60.0	U	60.0	U	60.0	U	60.0	U	60.0	U
ARSENIC	50					15.0	U	15.0	U	15.0	U	15.0	U	15.0	U	15.0	U
BARIUM	2000					15.7		15.5		15.2		15.7		200	U	200	U
BERYLLIUM	4					5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
CADMIUM	5					0.14		5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
CALCIUM						190000		193000		182000		191000		14.4		31.7	
CHROMIUM	100					9.8		10.0	U	9.4		10.0	U	10.0	U	10.0	U
COBALT	1000					50.0	U	50.0	U	50.0	U	50.0	U	50.0	U	50.0	U
COPPER	650					114		0.60		71.3		1.0		25.0	U	25.0	U
IRON	5000					21600		4800		19300		4860		100	U	100	U
LEAD	7.5					49.2		10.0	U	44.6		10.0	U	10.0	U	10.0	U
MAGNESIUM						174000		172000		172000		171000		5000	U	13.9	
MANGANESE	150					369		230		351		227		15.0	U	15.0	U
MERCURY	2					0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
NICKEL	100					7.9		40.0	U	7.3		40.0	U	40.0	U	40.0	U
POTASSIUM						6710	J	5860	J	6580	J	5830	J	5000	UJ	5000	UJ
SELENIUM	50					35.0	U	35.0	U	35.0	U	35.0	U	35.0	U	35.0	U
SILVER	50					10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U
SODIUM						21600		21800		21400		21800		274		255	
THALLIUM	2					25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U
VANADIUM	49					0.48		50.0	U	0.48		50.0	U	50.0	U	50.0	U
ZINC	5000					12300		3380		11000		3260		3.6		4.7	
CYANIDE	200					10.0	U			10.0	U			10.0	U		

Values highlighted in YELLOW exceed corresponding benchmark level.

* - If cell is empty, no benchmarks are available.

** - Insufficient amount of water recovered to analyze for this fraction.

*** - Sample Number followed by "F" indicates sample has been field filtered and sample is of soluble inorganic analytes.

PLOT M - PALOS FOREST PRESERVE
SOIL & SEDIMENT SAMPLE DESCRIPTIONS
TABLE 4

SAMPLE	DEPTH	APPEARANCE	TVA READINGS (units) * PID	FID	RADIATION BETA (Cts/min.)	READINGS GAMMA (Cts/min.)	LOCATION
X101 (Background)	4.0' - 5.5'	Lt. - med. Tan - orangish tan dry clayey silt w/ dk.- med. gray mottling.	0.36	2.26			Adjacent to site access road south of the site.
X102 (Background)	14.5' - 16'	Lt. - med. Tan - orangish tan dry clayey silt w/ dk.- med. gray mottling.	0.36	2.26			Deep sample in same borehole as X101.
X102 Radiological Sample	13' - 14'	Lt. - med. Tan - orangish tan dry clayey silt w/ dk.- med. gray mottling.	0.36	2.26	100 or <	6000-7000	Deep sample in same borehole as X101.
X103	4' - 5.5'	Lt. - med tan silty clay w/orange mottling throughout.	0.4	1.35			Immediately adjacent to the southwest corner of the site.
X104	15' - 16'	Lt. - med tan silty clay w/orange mottling throughout.	0.4	1.35			Deep sample in same borehole as X103.
X104 Radiological Sample	13' - 14'	Lt. - med tan silty clay w/orange mottling throughout.	0.4	1.35	100 or <	6000-7000	Deep sample in same borehole as X103.
X105	4' - 5'	Lt. - med tan - Lt. Brn. moist clayey silty till, hard.	0.36	2.26			Immediately adjacent to the south-southwest corner of the site.
X106	15.' - 16'	Lt. - Med. Tan w/orange mottling. Hard	0.36	2.26			Deep sample in same borehole as X105.
X106 Radiological Sample	11' - 12'	Lt. - Med. Tan w/orange mottling. Dry, hard, friable.	0.36	2.26	100 or <	6000-7000	Deep sample in same borehole as X105.
X107	4' - 5.5'	Mottled Med. Tan - orange tan till/silty clay w/limestone or dolomite chips.	2.35	2.5			Immediately adjacent to the west edge of the concrete cap just south of the NW corner.
X108	15' - 17'	Same as above	2.35	2.5			Deep sample in same borehole as X107.
X108 Radiological Sample	16' - 18'	Same as above	2.35	2.5	100 or <	6000-7000	Deep sample in same borehole as X107.
X109/X110 (Dup of X109)	4' - 5'	Lt. - Med. Tan - Lt. Brn. Moist clayey silty till. Hard.	0.3	2.45			Immediately adjacent to the north edge of the concrete cap approx. 30' west of NE corner.
X111	14' - 16'	Lt. - Med. Tan w/ orange mottling. Hard.	0.3	2.45			Deep sample in same borehole as X109/X110.
X111 Radiological Sample	13' - 15'	Lt. - Med. Tan w/ orange mottling. Hard.	0.3	2.45	100 or <	6000-7000	Deep sample in same borehole as X109/X110.
X112	4' - 5.5'	Med. Brn clayey, silty till.	0.45	2.3			Sample point is approx. 1200 ft. north of the Plot M site, at the east end of the Red Gate Woods Picnic Area parking lot, north of curb.
X113	14.5' - 16'	Lt. - med. Tan clayey silt, moist. hard.	0.45	2.3			Deep sample in same borehole as X112.
X113 Radiological Sample	12.5' - 14.5'	Lt. Tan clayey silt, wet.	0.45	2.3	100 or <	3500-4500	Deep sample in same borehole as X112.

Site scanning radiation meters used to screen the overall site and surroundings and the six deep samples consisted of a gamma scintillation meter and a Geiger-Mueller meter.
The Geiger-Mueller meter was used to measure beta particles, gamma rays, and alpha particles on site. The background was 100 counts/min. (cpm) or less.
- The gamma scintillation meter measures gamma radiation. The off site background was found to be approx. 6500 cpm, on site was approx. 10,000 cpm.

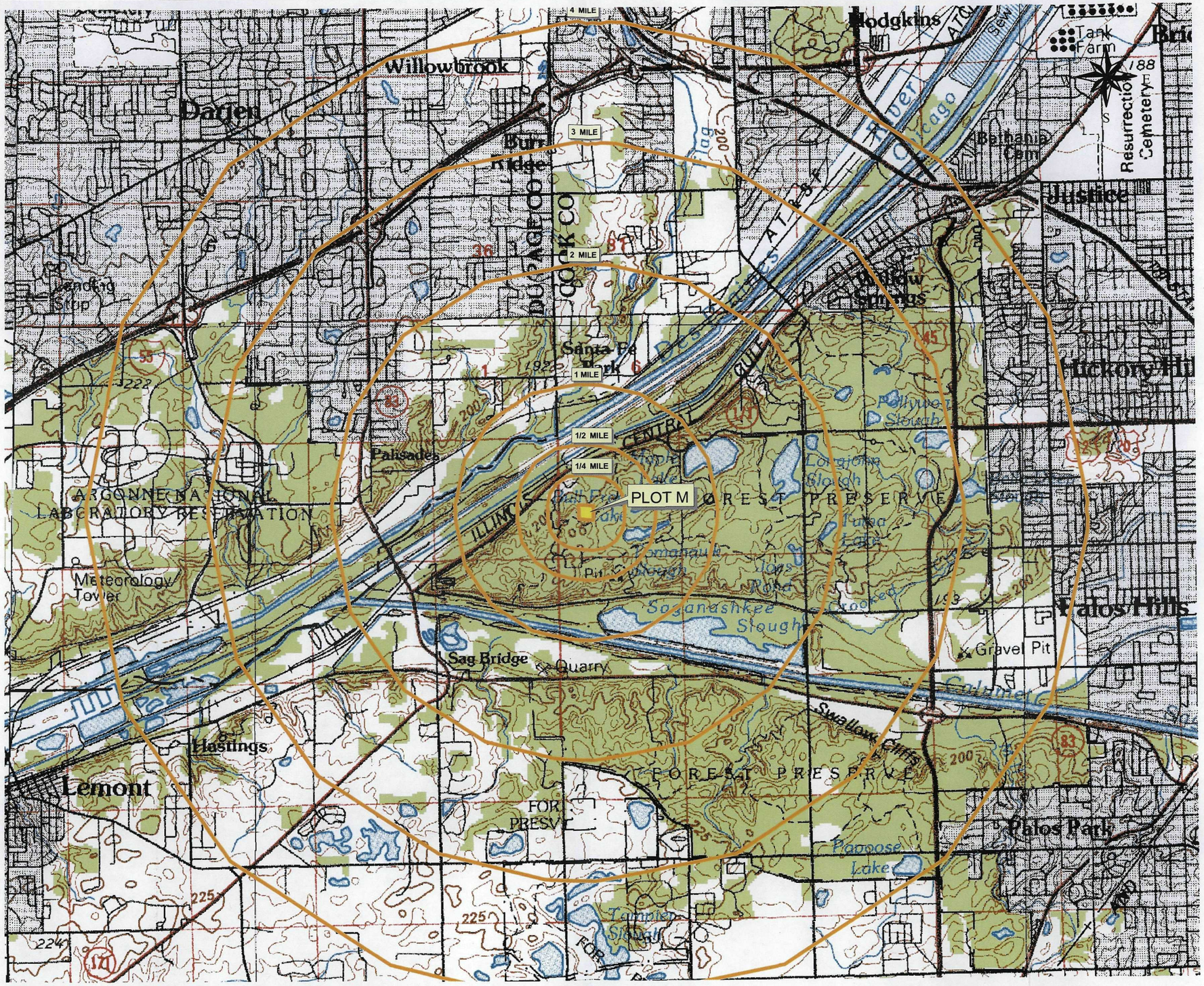
PLOT M - PALOS FOREST PRESERVE
SOIL & SEDIMENT SAMPLE DESCRIPTIONS
TABLE 4
(CONT.)

SAMPLE	DEPTH	APPEARANCE	TVA READINGS (units) * PID	FID	LOCATION
X201	6" - 8"	Tan - Black silt and clay, abundant organic matter. Beneath water surface.	N/A	N/A	Sediment surface west of confluence of intermittent drainage ditch and the I & M Canal.
X202	6" - 8"	Tan - Black silt and clay, abundant organic matter. Beneath water surface.	N/A	N/A	Sediment surface east of confluence of intermittent drainage ditch and the I & M Canal.
X203	0" - 3"	Med. Tan gravelly, sandy silt. Beneath water surface.	N/A	N/A	Sediment surface of intermittent stream east of the Red Gate Woods Picnic Area.
X204/X205 (Dup of X204)	0" - 3"	Med. Tan gravelly, sandy silt. Beneath water	N/A	N/A	Approximately 600 feet NE of the Plot M site in the intermittent stream. Near Argonne sample point #11.
X206	0" - 3"	Med. Tan gravelly, sandy silt. Beneath water surface.	N/A	N/A	Approximately 200 feet north of Plot M in the intermittent stream. Near Argonne sample point #9.
X207	0" - 3"	Med. Tan gravelly, sandy silt. Beneath water surface.	N/A	N/A	Approximately 100 feet north of Plot M in the western intermittent drainage ditch, prior to its confluence w/the east intermittent stream. Near Argonne sample point #8.
X208	0" - 4"	Med.- Dk. Tan gravelly, silty sand. Beneath water surface.	N/A	N/A	Just downstream of the confluence of the two intermittent drainage ways, north of the site. Near Argonne sample point #7.
X209	0" - 2"	Dk. Brn. Silt. Organic matter present. Beneath water surface.	N/A	N/A	Adjacent to the north slope of the site near a seep at the base of the slope which drains into the main intermittent stream. Near Argonne sample point #6.
X210	0" - 3"	Med. - Dk. Brn. Silty, sandy gravel. Beneath water surface.	N/A	N/A	In intermittent stream at base of slope, down slope of NE corner of Plot M. Near Argonne sample point #5.
X211	0" - 3"	Lt. - Med. Tan, sandy silt w/gravel. Beneath water surface.	N/A	N/A	In intermittent stream at base of slope, down slope of east perimeter of Plot M. Near Argonne sample point #4.
X212	0" - 3"	Lt. - Med. Tan, sandy silt w/gravel. Beneath water surface.	N/A	N/A	In intermittent stream at base of slope, down slope of SE corner of Plot M. Near Argonne sample point #3.
X213	0" - 3"	Lt. - Med. Tan, sandy silt w/gravel. Beneath water surface.	N/A	N/A	In intermittent stream approx. 100 ft. upstream of Plot M. Near Argonne sample point #2.
X214	0" - 4"	Lt. - Med. Tan, sandy silt w/gravel. Beneath water surface.	N/A	N/A	In intermittent stream approx. 200 ft. upstream of Plot M. Near Argonne sample point #1. (Intermittent stream background).

APPENDICES

Appendix A

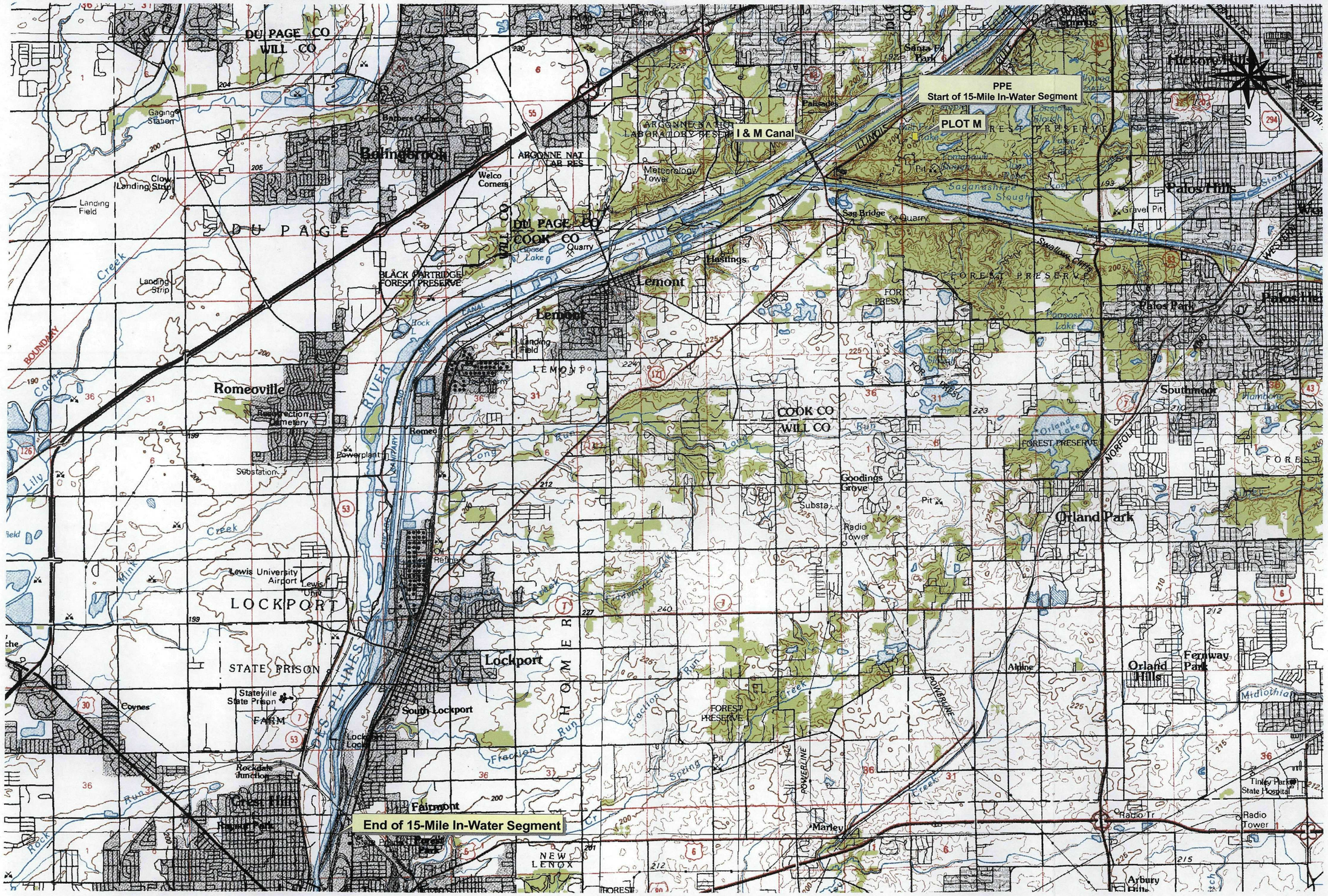
4-Mile Radius Map



Plot M - Palos Forest Preserve
4 - Mile Radius Map

Appendix B

15-Mile Surface Water Route Map



Plot M - Palos Forest Preserve
15 - Mile In - Water Segment

Appendix C

Target Compound List

TARGET COMPOUND LIST

Volatile Target Compounds

Chloromethane	1,2-Dichloropropane
Bromomethane	cis-1,3-Dichloropropene
Vinyl Chlorde	Trichloroethene
Chloroethane	Dibromochloromethane
Methylene Chloride	1,1,2-Trichloroethane
Acetone	Benzene
Carbon Disulfide	trans-1,3-Dichloropropene
1,1-Dichloroethene	Bromoform
1,1-Dichloroethane	4-Methyl-2-pentanone
1,2-Dichloroehtene (total)	2-Hexanone
Chloroform	Tetrachloroethene
1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
2-Butanone	Toluene
1,1,1-Trichloroethane	Chlorobenzene
Carbon Tetrachloride	Ethylbenzene
Vinyl Acetate	Styrene
Bromodichloromethane	Xylenes (total)

Base/Neutral Target Compounds

Hexachloroethane	2,4-Dinitrotoluene
bis(2-Chloroethyl) Ether	Diethylphthalate
Benzyl Alcohol	N-Nitrosodiphenylamine
bis (2-Chloroisopropyl) Ether	Hexachlorobenzene
N-Nitroso-Di-n-Propylamine	Phenanthrene
Nitrobenzene	4-Bromophenyl-phenylether

Hexachlorobutadiene	Anthracene
2-Methylnaphthalene	Di-n-Butylphthalate
1,2,4-Trichlorobenzene	Fluoranthene
Isophorone	Pyrene
Naphthalene	Butylbenzylphthalate
4-Chloroaniline	bis(2-Ethylhexyl)Phthalate
bis(2-chloroethoxy)Methane	Chrysene
Hexachlorocyclopentadiene	Benzo(a)Anthracene
2-Chloronaphthalene	3-3'-Dichlorobenzidene
2-Nitroaniline	Di-n-Octyl Phthalate
Acenaphthylene	Benzo(b)Fluoranthene
3-Nitroaniline	Benzo(k)Fluoranthene
Acenaphthene	Benzo(a)Pyrene
Dibenzofuran	Ideno(1,2,3-cd)Pyrene
Dimethyl Phthalate	Dibenz(a,h)Anthracene
2,6-Dinitrotoluene	Benzo(g,h,i)Perylene
Fluorene	1,2-Dichlorobenzene
4-Nitroaniline	1,3-Dichlorobenzene
4-Chlorophenyl-phenylether	1,4-Dichlorobenzene

Acid Target Compounds

Benzoic Acid	2,4,6-Trichlorophenol
Phenol	2,4,5-Trichlorophenol
2-Chlorophenol	4-Chloro-3-methylphenol
2-Nitrophenol	2,4-Dinitrophenol
2-Methylphenol	2-Methyl-4,6-dinitrophenol
2,4-Dimethylphenol	Pentachlorophenol
4-Methylphenol	4-Nitrophenol
2,4-Dichlorophenol	

Pesticide/PCB Target Compounds

alpha-BHC	Endrin Ketone
beta-BHC	Endosulfan Sulfate
delta-BHC	Methoxychlor
gamma-BHC (Lindane)	alpha-Chlordane
Heptachlor	gamma-Chlordane
Aldrin	Toxaphene
Heptachlor epoxide	Aroclor-1016
Endosulfan I	Aroclor-1221
4,4'-DDE	Aroclor-1232
Dieldrin	Aroclor-1242
Endrin	Aroclor-1248
4,4'-DDD	Aroclor-1254
Endosulfan II	Aroclor-1260
4,4'-DDT	

TARGET ANALYTE LIST

Inorganic Compounds

Aluminum	Manganese
Antimony	Mercury
Arsenic	Nickel
Barium	Potassium
Beryllium	Selenium
Cadmium	Silver
Calcium	Sodium
Chromium	Thallium
Cobolt	Vanadium
Copper	Zinc
Iron	Cyanide
Lead	Sulfide
Magnesium	

List of PNA's from Target Compound List

Naphthalene

2-Methylnaphthalene

2-Chloronaphthalene

Acenaphthylene

Acenaphthene

Fluorene

Phenanthrene

Anthracene

Fluoranthene

Pyrene

Benzo(a)anthracene

Chrysene

Benzo(b)fluoranthene

Benzo(k)fluoranthene

Benzo(a)pyrene

Indeno(1,2,3-cd)pyrene

Dibenz(a,h)anthracene

Benzo(g,h,i)perylene

DATA QUALIFIERS

QUALIFIER	DEFINITION ORGANICS	DEFINITION INORGANICS
U	Compound was tested for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture. For soil samples subjected to GPC clean-up procedures, the CRQL is also multiplied by two, to account for the fact that only half of the extract is recovered.	Analyte was analyzed for but not detected.
J	Estimated value. Used when estimating a concentration for tentatively identified compounds (TICS) where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria and the result is less than the sample quantitation limit but greater than zero. Used in data validation when the quality control data indicate that a value may not be accurate.	Estimated value. Used in data validation when the quality control data indicate that a value may not be accurate.
C	This flag applies to pesticide results where the identification is confirmed by GC/MS.	Method qualifier indicates analysis by the Manual Spectrophotometric method.
B	Analyte was found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.	The reported value is less than the CRDL but greater than the instrument detection limit (IDL).
D	Identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor as in the "E" flag, the "DL" suffix is appended to the sample number on the *Form I for the diluted sample, and all concentration values* are flagged with the "D" flag.	Not used.
E	Identifies compounds whose concentrations exceed the calibration range for that specific analysis. All extracts containing compounds exceeding the calibration range must be diluted and analyzed again. If the dilution of the extract causes any compounds identified in the first analysis to be below the calibration range in the second analysis, then *the results of both analyses must be reported on separate Forms I. The Form I for the diluted* sample must have the "DL" suffix appended to the sample number.	The reported value is estimated because of the presence of interference.
A	This flag indicates that a TIC is a suspected aldol concentration product formed by the reaction of the solvents used to process the sample in the laboratory.	Method qualifier indicates analysis by Flame Atomic Absorption (AA).
M	Not used.	Duplicate injection (a QC parameter not met).

N	Not used	Spiked sample (a QC parameter not met).
S	Not used.	The reported value was determined by the Method of Standard Additions (MSA).
W	Not used.	Post digestion spike for Furnace AA analysis (a QC parameter) is out of control limits of 85% to 115% recovery, while sample absorbance is less than 50% of spike absorbance.
*	Not used.	Duplicate analysis (a QC parameter not within control limits).
+	Not used.	Correlation coefficient for MSA (a QC parameter) is less than 0.995.
P	Not used.	Method qualifier indicates analysis by ICP (Inductively Coupled Plasma) Spectroscopy.
CV	Not used.	Method qualifier indicates analysis by Cold Vapor AA.
AV	Not used.	Method qualifier indicates analysis by Automated Cold Vapor AA.
AS	Not used.	Method qualifier indicates analysis by Semi-Automated Cold Spectrophotometry.
T	Not used.	Method qualifier indicates Titrimetric analysis.
NR	The analyte was not required to be analyzed.	The analyte was not required to be analyzed.
R	Rejected data. The QC parameters indicate that the data is not usable for any purpose.	Rejected data. The QC parameters indicate that the data is not usable for any purpose.

Appendix D

Illinois EPA Sample Photographs

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903256	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1320
PHOTO BY: Ken Corkill
SAMPLE: X201
DIRECTION: East
COMMENTS: Photo taken in the I & M Canal downstream of its confluence with the unnamed intermittent stream that receives runoff and seepage from Plot M.

DATE: April 8, 2003
TIME: 1320
PHOTO BY: Ken Corkill
SAMPLE: X201
DIRECTION: West
COMMENTS: Same description as above.

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903286	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1340
PHOTO BY: Ken Corkill
SAMPLE: X202
DIRECTION: East
COMMENTS: Photo taken in the I & M Canal upstream of its confluence with the unnamed intermittent stream that receives runoff and seepage from Plot M.

DATE: April 8, 2003
TIME: 1340
PHOTO BY: Ken Corkill
SAMPLE: X202
DIRECTION: West
COMMENTS: Same description as above.

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903286	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1430
PHOTO BY: Ken Corkill
SAMPLE: X203
DIRECTION: South
COMMENTS: Photo taken in intermittent stream downstream of Plot M and east of Red Gate Woods Picnic Area.

DATE: April 8, 2003
TIME: 1450
PHOTO BY: Ken Corkill
SAMPLE: X204 & X205
DIRECTION: South
COMMENTS: Photo taken in intermittent stream approximately 700 ft. downstream of Plot M.

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903286	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1450
PHOTO BY: Ken Corkill
SAMPLE: X204 & X205
DIRECTION: North
COMMENTS: Photo taken in intermittent stream approximately 600 ft. downstream of Plot M.

DATE: April 8, 2003
TIME: 1540
PHOTO BY: Ken Corkill
SAMPLE: X206
DIRECTION: South
COMMENTS: Photo taken in intermittent stream approximately 200 ft. downstream of Plot M.

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903286	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1540
PHOTO BY: Ken Corkill
SAMPLE: X206
DIRECTION: North
COMMENTS: Same description as above.

DATE: April 8, 2003
TIME: 1550
PHOTO BY: Ken Corkill
SAMPLE: X207
DIRECTION: South
COMMENTS: Photo taken in the western intermittent stream approximately 30 ft. upstream of its confluence with the primary (eastern) intermittent stream Approx. 100 ft. downstream of Plot M.

SITE NAME: PLOT M – PALOS FOREST PRESERVE	
CERCLIS ID: ILD 984903286	**COUNTY:** COOK

DATE: April 8, 2003
TIME: 1605
PHOTO BY: Ken Corkill
SAMPLE: X208
DIRECTION: North
COMMENTS: Photo taken in primary (eastern) intermittent stream Approx. 100 ft. downstream of Plot M.

DATE: April 8, 2003
TIME: 1605
PHOTO BY: Ken Corkill
SAMPLE: X208
DIRECTION: South
COMMENTS: No photograph. Camera drive malfunction. No further photos.

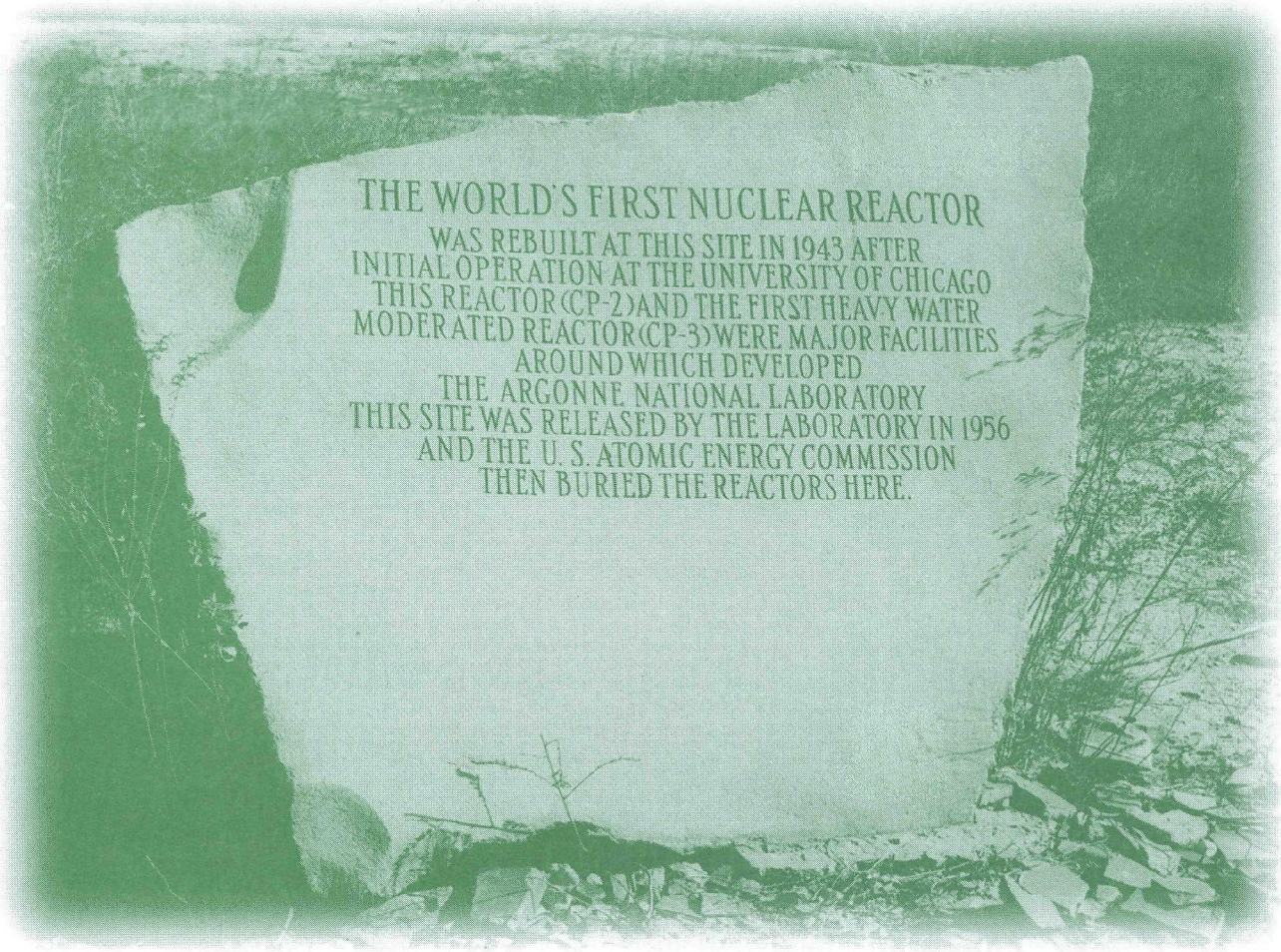
Appendix E

Surveillance of Site A and Plot M – Report for 2001
Argonne National Laboratory

ANL-02/1

Surveillance of Site A and Plot M Report for 2001

Norbert W. Golchert
The Office of ESH/QA Oversight



Argonne National Laboratory, Argonne, Illinois 60439
operated by The University of Chicago
for the United States Department of Energy under Contract W-31-109-Eng-38

Available electronically at http://www.doe.gov/bridge

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

ANL- 02/1

ARGONNE NATIONAL LABORATORY-EAST
9700 South Cass Avenue
Argonne, Illinois 60439

SURVEILLANCE OF SITE A AND PLOT M

Report for 2001

by

Norbert W. Golchert

The Office of ESH/QA Oversight

June 2002

Prepared for the U. S. Department of Energy
Work Package ANL 035 00 02 -- WBS No. AH-10-05-121I

PREFACE

This report is prepared for the U. S. Department of Energy (DOE) by the Office of ESH/QA Oversight (EQO) at Argonne National Laboratory-East (ANL-E). The results of the environmental monitoring program at Site A and Plot M and an assessment of the impact of the site on the environment and the public are presented in this publication. Funding to support this program was provided by the Office of Environmental Management through the U. S. Department of Energy Grand Junction Office. This report and some earlier issues of the annual reports are available on the Internet at http://www.anl.gov/ESH/sitea/2001.

Most of the tables and some of the figures were prepared by Jennifer Tucker of the Data Management Team. Sample collection and field measurements were conducted under the direction of Ronald Kolzow of the EQO Environmental Monitoring and Surveillance Group by:

Tony Fracaro
Dan Milinko

The analytical separations and measurements were conducted by the Environmental, Safety, and Health-Analytical Chemistry Laboratory of the Chemical Technology Division by:

Tim Branch
Theresa Davis
Alan Demkovich
Gary Griffin
Richard Kasper
Denise Seeman
Christos Stamoudis
Emmer Thompson
John Zhang

This manuscript was typed and prepared for publication by Rita M. Beaver (EQO).

TABLE OF CONTENTS

Page

LIST OF TABLES (Contd.)

LIST OF FIGURES

SURVEILLANCE OF SITE A AND PLOT M

Report for 2001

by

Norbert W. Golchert

ABSTRACT

The results of the environmental surveillance program conducted at Site A/Plot M in the Palos Forest Preserve area for Calendar Year 2001 are presented. Based on the results of the 1976-1978 radiological characterization of the site, a determination was made that a surveillance program be established. The characterization study determined that very low levels of hydrogen-3 (as tritiated water) had migrated from the burial ground and were present in two nearby hand-pumped picnic wells. The current surveillance program began in 1980 and consists of sample collection and analysis of surface and subsurface water. The results of the analyses are used to 1) monitor the migration pathway of water from the burial ground (Plot M) to the handpumped picnic wells, 2) establish if buried radionuclides other than hydrogen-3 have migrated, and 3) monitor the presence of radioactive and chemically hazardous materials in the environment of the area. Hydrogen-3 in the Red Gate Woods picnic wells was still detected this year, but the average and maximum concentrations were significantly less than found earlier. Hydrogen-3 continues to be detected in a number of wells, boreholes, dolomite holes, and a surface stream. Analyses since 1984 have indicated the presence of low levels of strontium-90 in water from a number of boreholes next to Plot M. The results of the surveillance program continue to indicate that the radioactivity remaining at Site A/Plot M does not endanger the health or safety of the public visiting the site, using the picnic area, or living in the vicinity.

INTRODUCTION

1.1 Site History

This report presents and discusses the surveillance data obtained during 2001. The surveillance program is the ongoing activity that resulted from the 1976-1978 radiological characterization of the former site of Argonne National Laboratory and its predecessor, the University of Chicago's Metallurgical Laboratory. This site was part of the World War II Manhattan Engineer District Project and was located in the Palos Forest Preserve southwest of Chicago, IL. The Laboratory used two locations in the Palos Forest Preserve: Site A, a 19-acre area that contained experimental laboratories and nuclear reactor facilities; and Plot M, a 150 ft x 140 ft area used for the burial of radioactive waste. These locations are shown in Figure 1.1 and Figure 1.2. Previous comprehensive reports on this subject[1,2] provide additional detail and illustrations on sampling locations and provide descriptive material along with the results through 1981. There are annual reports for 1982 through 2000.[3-21] While earlier data will not be repeated in this report, reference is made to some of the results.

Operations at Site A began in 1943 and ceased in 1954. Among the research programs carried out at Site A were reactor physics studies, fission product separations, hydrogen-3 recovery from irradiated lithium, and work related to the metabolism of radionuclides in laboratory animals. Radioactive waste and radioactively-contaminated laboratory articles from these studies were buried at Plot M. At the termination of the programs, the reactor fuel and heavy water, used for neutron moderation and reactor cooling, were removed and shipped to Oak Ridge National Laboratory. The biological shield for the CP-3 reactor located at Site A, together with various pipes, valves, and building debris, was buried in place in 1956.

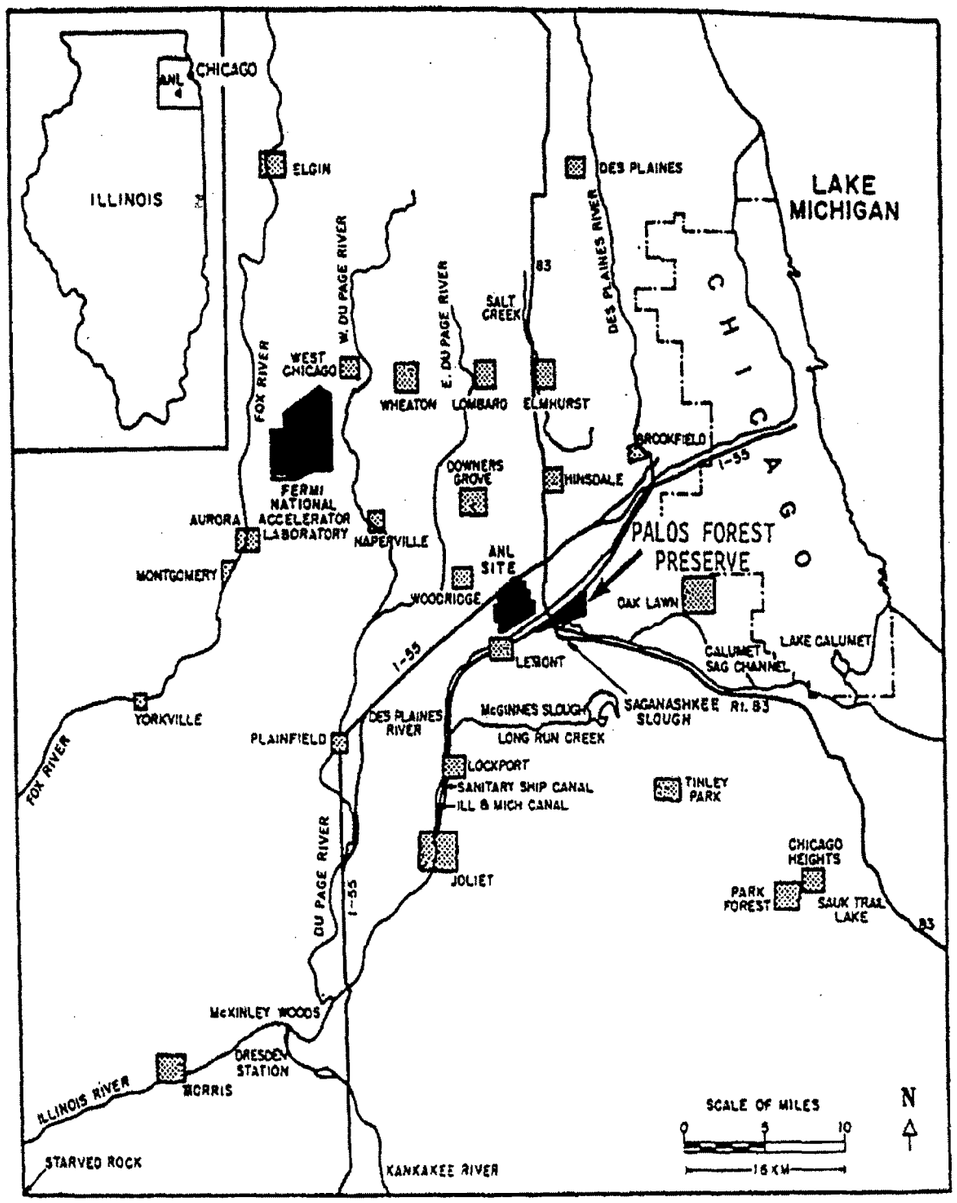


Figure 1.1 Location of Palos Forest Preserve on Chicago-Area Map

Burial of radioactive waste at Plot M began in 1944 and was discontinued in 1949. Waste was buried in six-foot deep trenches and covered with soil until 1948, after which, burial took place in steel bins. The steel bins were removed in 1949 and sent to Oak Ridge National Laboratory for disposal, but the waste buried in trenches was allowed to remain in place. Concrete sidewalls, eight feet deep, were poured around the perimeter of the burial area and a one-foot thick reinforced concrete slab was poured over the top. The concrete slab was covered with soil and seeded with grass. Both the Site A and Plot M areas were decommissioned in 1956.

In 1973, elevated levels of hydrogen-3 (as tritiated water) were detected in two nearby hand-pumped picnic wells (#5167 and #5159) and the hydrogen-3 was found to be migrating from the burial plot into the surrounding soil and aquifers. As a result, a radiological survey of the entire Palos Forest Preserve site was conducted with special emphasis on the Site A and Plot M areas.[1]

In 1990, elevated levels of radioactivity were discovered outside the original fenced area. An expanded characterization and remediation program was conducted by DOE to remove residual radioactivity and document the remediation of the area. This was completed in 1997.

The terminology used in previous reports is continued in this report. A hole drilled and completed into the glacial till is called a borehole. The soil samples obtained from the borehole are called soil cores. Some boreholes have been cased and screened to form monitoring wells. Water from such wells is called groundwater. Test wells drilled into the dolomite bedrock are called dolomite holes or deep holes. Water from such wells is called dolomite water. The hand-pumped picnic wells, which are completed into or close to the dolomite bedrock, are called water wells or picnic wells. They are identified by a location name or well number. Except for well #5160, these were in existence before this radiological and hydrological study of the area was begun.

The results of radioactivity measurements are expressed in this report in terms of picocuries per liter (pCi/L) and nanocuries per liter (nCi/L) for water samples. Radiation effective dose equivalent calculations are reported in units of millirem (mrem) or millirem per year (mrem/y). The use of the term dose throughout this report means effective dose equivalent. Other abbreviations of units are defined in the text.

1.2 Site Characteristics

Geologically, Plot M is constructed on a moraine upland which is dissected by two valleys, the Des Plaines River valley to the north and the Calumet Sag valley to the south. The upland is characterized by rolling terrain with poorly developed drainage. Streams are intermittent and drain internally or flow to one of the valleys. The area is underlain by glacial drift, dolomite, and other sedimentary rocks. The uppermost bedrock is Silurian dolomite, into which both the picnic wells and some of the monitoring wells are placed, as described in the text. The dolomite bedrock is about 200 feet thick. The overlying glacial drift has a thickness that ranges from 165 feet at Site A to zero at the Des Plaines River and Calumet Sag Canal, and some of the monitoring wells terminate in this layer. The depth to bedrock at Plot M is about 130 feet.

Hydrologically, the surface water consists of ponds and intermittent streams. When there is sufficient water, the intermittent stream that drains Plot M flows from the highest point near Site A, past Plot M, then continues near the Red Gate Woods well (Figure 1.2) and discharges into the Illinois and Michigan (I&M) Canal. The groundwater in the glacial drift and dolomite forms two distinct flow systems. The flow in the drift is controlled principally by topography. The flow in the dolomite, which is recharged by groundwater from the glacial drift, is controlled by two discharge areas, the Des Plaines River to the north and the Calumet Sag Canal to the south. Water usage in the area is confined to the hand-pumped picnic wells. These wells are open to the dolomite and are principally used in the warmer seasons.

The climate is that of the upper Mississippi valley, as moderated by Lake Michigan, and is characterized by cold winters and hot summers. Precipitation averages about 33 inches annually. The largest rainfalls occur between April and September. The average monthly temperature ranges from 21°F in January to 73°F in July. Approximately 8.9 million people reside within 50 miles of the site; the population within a five-mile radius is about 150,000. The only portion of the Palos Forest Preserve in the immediate area of Plot M and Site A that is developed for public use is the Red Gate Woods picnic area (Figure 1.2), although small numbers of individuals use the more remote areas of the Palos Forest Preserve.

2.0 SUMMARY

The results of the ongoing environmental monitoring and surveillance program at the Palos Forest Preserve site for 2001 are presented in this report. Sample collection and analyses for radioactive substances were conducted on surface and subsurface water and for nonradioactive substances in subsurface water.

Surface water samples collected from the stream that flows around Plot M showed the same hydrogen-3 concentration pattern seen in the past. Concentrations were at the ambient level of less than 0.1 nCi/L upstream of the Plot, increased up to 66.9 nCi/L at the seep adjacent to the Plot, then decreased to less than 0.1 nCi/L further downstream.

The hydrogen-3 concentrations in the borehole and dolomite hole water follow a pattern consistent with that observed in the past. The hydrogen-3 concentration was highest in those boreholes nearest Plot M and downgradient of the Plot. Water from five of 13 boreholes analyzed for strontium-90 contained concentrations greater than the detection limit of 0.25 pCi/L. The elevated strontium-90 levels (up to 1.98 pCi/L) found in some boreholes are probably from the Plot, since concentrations above 0.25 pCi/L have not been observed in the groundwater due to atmospheric fallout from previous nuclear weapons testing, and no other source is known. Strontium-90 is a relatively mobile radionuclide and its presence in the borehole water is not unexpected and is probably due to migration that occurred before the Plot was capped. The strontium-90 results are consistent with those measured in the past.

Sampling of the forest preserve picnic wells shown in Figure 1.2 continued. In July 1988, the Red Gate Woods North Well (#5160) was installed as a replacement drinking water supply for the Red Gate Woods Well (#5167). The maximum and average hydrogen-3 concentrations of well #5160 were 1.59 nCi/L and 1.49 nCi/L, respectively. The well opposite the entrance to Red Gate Woods (#5159) had a maximum hydrogen-3

concentration of 0.27 nCi/L and an annual average concentration of 0.16 nCi/L. The other wells all averaged less than 0.1 nCi/L, except well #5158 which averaged 0.12 nCi/L. The previous pattern of relatively higher hydrogen-3 concentrations in the winter and relatively lower concentrations (less than the detection limit of 0.1 nCi/L) in the summer is not readily apparent for the wells due to the overall low measured hydrogen-3 concentrations. For the calculation of annual averages, all data, as measured, were retained in the data base and used to compute the average. Non-radiological monitoring of Non Responsive identified elevated levels of copper, iron, lead, and zinc which are attributed to the decomposition of the well pump materials.

If water equal to the Red Gate Woods North Well (Non Responsive) average concentration of 1.49 nCi/L was the sole source of water for an individual, the annual dose from hydrogen-3 would be 0.069 mrem using the DOE dose conversion factor.[22] Consumption of one liter of this water would produce a dose of 9×10^{-5} mrem. Although the U. S. Environmental Protection Agency (EPA) drinking water regulations[23] are not applicable because the picnic wells do not meet the EPA definition of a public drinking water supply, this concentration is about 7% of the EPA annual limit of 20 nCi/L. Table 4.3 provides a relative comparison of this calculated dose to natural and other sources of radiation.

The results of this program show that the radioactivity remaining at Site A, Plot M, and the Red Gate Woods area does not endanger the health or safety of the public visiting the site or those living in the vicinity. The potential radiation doses are very low compared to the relevant standards.

3.0 MONITORING PROGRAM

The monitoring program is designed to assess the elevated hydrogen-3 (as tritiated water) concentrations in some of the picnic wells in the Palos Forest Preserve. This is accomplished by analyzing water from wells, deep holes, boreholes, and surface streams in the area. Samples are collected with a frequency ranging from biweekly to annually, depending on past results and proximity to Plot M. During 2001, 340 samples were collected, 927 analyses were performed, and 200 field measurements were conducted. For the most part, individual results are presented in the tables and compared to control, off-site, or upstream sample results. Where applicable, results are compared to the U. S. Department of Energy Radiation Protection Standard of 100 mrem/y.[22] The Site A/Plot M program follows the guidance for monitoring at DOE facilities.[24] Although it is recognized that Site A/Plot M is not a DOE facility, the same monitoring principles are applicable to this site.

The uncertainties associated with individual concentrations given in the tables are the statistical counting errors at the 95% confidence level. Because of the amount of hydrogen-3 data presented on a few tables, the uncertainty values are not included. In such cases, the following uncertainties apply:

Concentration (nCi/L)	Uncertainty (% of Conc.)
0.1-1.0	40-5%
1-10	5-1%
> 10	1%

The sensitivity for the measurement of hydrogen-3 in water has been improved. The current detection limit is 0.1 nCi/L. The previous detection limit was 0.2 nCi/L.

3.1 Surface Water

Four sets of water samples were collected during 2001 from the stream that flows around Plot M, primarily during the spring when the ground was no longer frozen but saturated. The stream was dry during scheduled sampling in the summer. The sampling locations are shown in Figure 3.1. Sample Location #10 is 100 yards north of Location #9 and sample Location #11 is 200 yards north of Location #9. The outfall into the I&M Canal is approximately 600 yards north of Plot M. The samples were analyzed for hydrogen-3 and the results are shown in Table 3.1. The same concentration pattern in the water flowing around Plot M was observed this year as in the past. Concentrations were low upstream of the Plot, increased as the stream flowed past the Plot, where it received hydrogen-3 that leached out of the burial site, then decreased downstream due to dilution by precipitation. The outfall sample was collected prior to discharge into the I&M Canal.

Using the methodology prescribed in the DOE guidance,[22] the committed effective dose equivalent from consumption of water can be calculated. The total quantity of an ingested radionuclide is obtained by multiplying the water concentration by the general public water ingestion rate of 730 L/y.[25] This annual intake is then multiplied by the 50-year Committed Effective Dose Equivalent (CEDE) factor.[26] The CEDE for hydrogen-3 in water is 6.3×10^{-5} rem/μCi. If a hypothetical individual used water with the same hydrogen-3 concentration as found in the seep (Location #6) as his sole source of water, the annual dose based on the maximum 2001 concentration of 66.9 nCi/L would be about 3.1 mrem/y and the dose based on the annual average seep concentration of 20.5 nCi/L would be 0.9 mrem/y. The DOE dose limit for the public is 100 mrem/y. Using the same calculations for concentrations at Location #9, the maximum concentration of 22.4 nCi/L would produce1.0 mrem/y and the 2001 average concentration of 11.2 nCi/L would give a dose of 0.5 mrem/y. Consumption of one liter of water with the same annual average concentration as at Location #9 would produce a dose of 0.0007 mrem/y. In general, the hydrogen-3 concentrations vary from year to year and are dependent on the amount of precipitation.

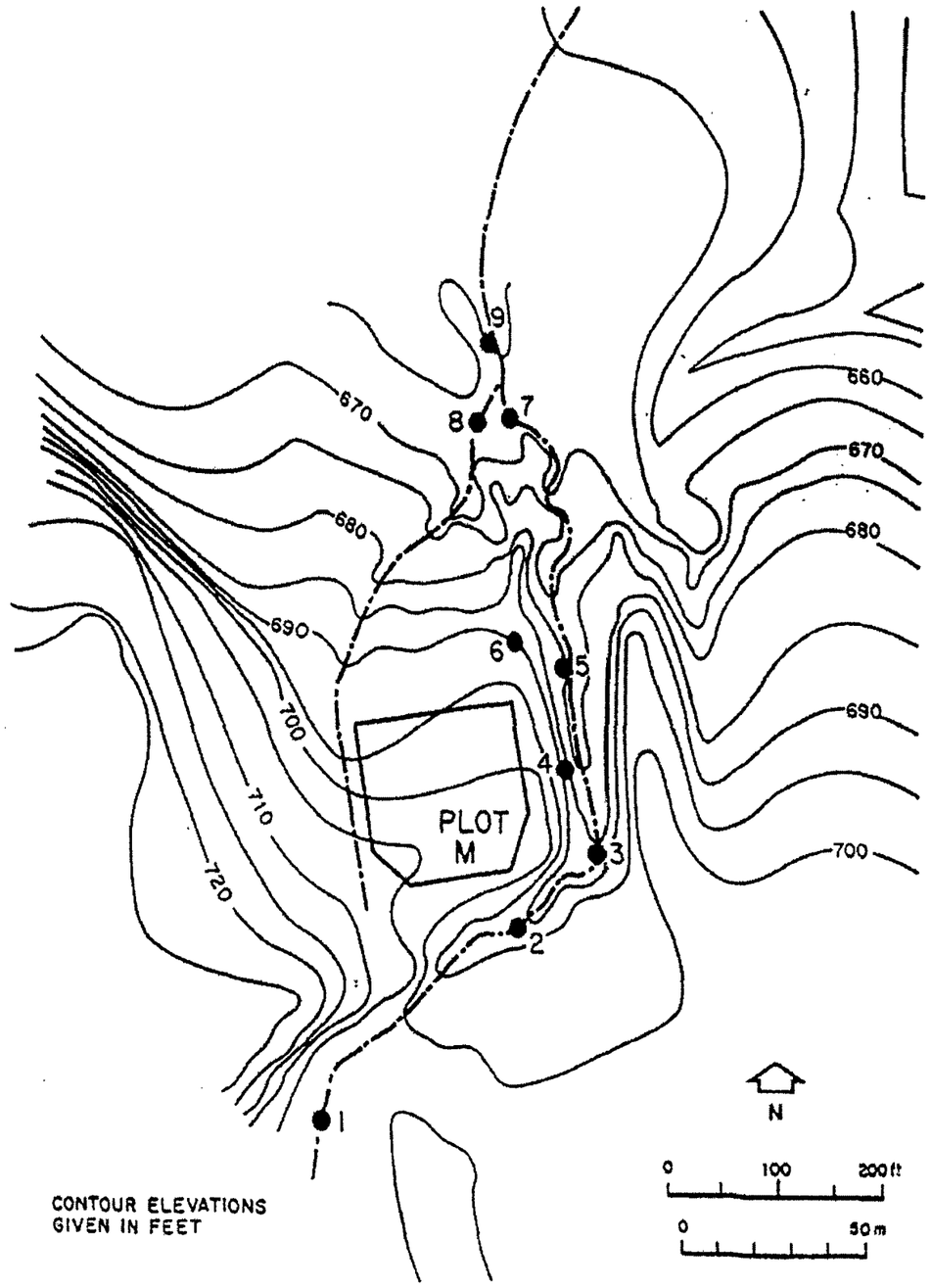


Figure 3.1 Surface Water Sampling Locations Near Plot M

TABLE 3.1

Hydrogen-3 Content of Stream Next to Plot M, 2001

(Concentrations in nCi/L)

Location Number*	Date Collected			
	March 15	May 21	October 5	December 6
1	< 0.1	< 0.1	< 0.1	< 0.1
2	< 0.1	< 0.1	< 0.1	< 0.1
3	< 0.1	0.2 ± 0.1	0.1 ± 0.1	< 0.1
4	2.0 ± 0.1	63.7 ± 0.3	5.6 ± 0.1	16.2 ± 0.1
5	2.2 ± 0.1	Dry	4.5 ± 0.1	15.9 ± 0.1
6 (Seep)	2.6 ± 0.1	8.2 ± 0.1	4.1 ± 0.1	66.9 ± 0.3
7	4.2 ± 0.1	26.3 ± 0.2	3.3 ± 0.1	20.2 ± 0.1
8	2.7 ± 0.1	41.7 ± 0.2	0.3 ± 0.1	14.5 ± 0.1
9	4.7 ± 0.1	22.4 ± 0.2	2.3 ± 0.1	15.0 ± 0.1
10	4.6 ± 0.1	7.7 ± 0.1	1.6 ± 0.1	6.1 ± 0.1
11	4.2 ± 0.1	1.8 ± 0.1	1.2 ± 0.1	3.5 ± 0.1
Outfall**	3.0 ± 0.1	Dry	0.1 ± 0.1	Dry

*See Figure 3.1
**I & M Canal

The annual collection of water samples from five surface water bodies in the vicinity of Site A occurred on September 25, 2001. These are: the pond northwest of Site A; the pond southeast of Site A; Horse Collar Slough; Tomahawk Slough; and Bull Frog Lake. Most of these locations can be identified in Figure 1.2. These samples were all analyzed for hydrogen-3 and the concentrations were all less than the detection limit of 0.1 nCi/L. The results indicate that there has been no surface migration of radioactive materials from Site A.

3.2 Subsurface Water

3.2.1 Borehole Water - Plot M

A number of the boreholes drilled in the Plot M area (Figure 3.2) were cased with plastic pipe and screens were installed to serve as sampling points within the glacial drift. Water samples were collected and water level measurements were made in the Plot M boreholes approximately bimonthly, weather permitting. Each borehole was emptied of water and allowed to recharge before sampling. The shallow boreholes responded to the spring precipitation as indicated by an increase in water levels followed by a drop during summer and fall when moisture was used for plant growth. The water levels in the deeper boreholes (> 100 ft) were relatively constant throughout the year. In July 2001, Boreholes 1, 11 (68 feet), 24, and 36 were closed in accordance with applicable State of Illinois regulations. The wells were closed because they were dry or not sealed properly and the remaining wells provide adequate coverage.

All the water samples were analyzed for hydrogen-3 and the results are collected in Table 3.2. The hydrogen-3 concentrations varied widely as in past years. The measured water levels in the boreholes are in Table 3.3. Since the measurement of the water levels is made relative to a benchmark at the top of the well casing, a decrease in numerical value indicates a rise in water level and dilution of the hydrogen-3. Higher hydrogen-3 concentrations in borehole water correlate with higher hydrogen-3 concentration in split-spoon soil cores obtained when the boreholes were constructed. In general, the magnitude of the hydrogen-3 concentrations are similar to those observed over the past several years.

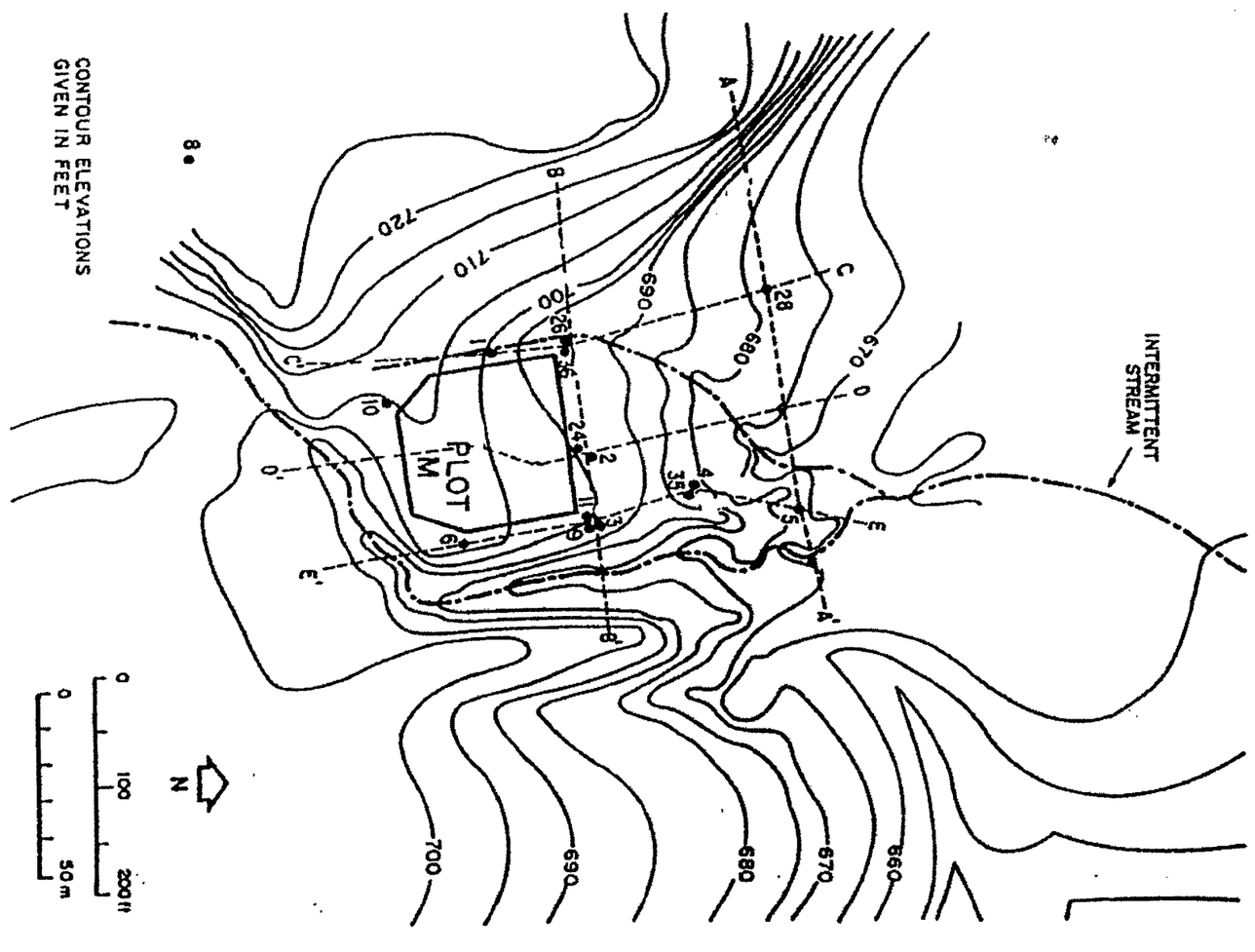


Figure 3.2 Map of Plot M Palos Site Showing Topography, Intermittent Stream, and Borehole Locations

TABLE 3.2

Hydrogen-3 in Plot M Borehole Water, 2001

(Concentrations in nCi/L)

Borehole Number	Depth (ft)	Date Collected					
		February 20	March 19	May 22	July 19	September 12	November 26
2	39.41	4761.0	508.1	67.8	63.7	249.2	684.9
3	40.00	397.4	1089.0	961.2	979.7	987.8	962.1
4	36.05	755.1	751.5	736.2	722.3	703.8	675.5
5	40.20	68.7	67.7	64.2	64.4	64.7	64.1
6	40.30	103.4	88.8	73.4	80.5	92.8	83.2
8	40.00	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
9	40.00*	0.2	1041.0	Dry	Dry	Dry	Dry
10	40.00*	< 0.1	0.3	3.2	148.0	238.5	34.2
11	39.30	219.2	211.5	195.2	224.8	223.4	196.2
11	121.90	16.4	8.3	17.7	34.2	17.0	23.1
26	60.65	0.3	2.8	46.7	457.7	338.2	450.5
28	58.25	63.6	8.1	27.8	44.8	49.9	53.7
35	105.50	735.3	Dry	382.3	475.7	589.1	472.5

* Slant hole drilled at 45° to a depth of 40 ft below the surface.

TABLE 3.3

Water Level Measurements in Boreholes Near Plot M, 2001

(Units of feet below the benchmark at the top of the well)

Borehole Number	Depth (ft)	Date Measured					
		February 20	March 19	May 22	July 19	September 12	November 26
2	39.41	23.65	20.58	23.80	27.18	28.49	26.80
3	40	35.10	33.70	30.66	32.07	33.60	32.85
4	36.05	16.80	15.20	14.50	18.20	20.46	17.96
5	40.20	25.30	23.80	21.50	23.20	25.43	24.09
6	40.30	34.25	33.18	31.11	32.80	35.77	32.95
8	40	35.78	33.47	35.70	35.97	35.94	36.07
11	39.30	20.38	15.58	21.68	25.65	27.07	24.82
11	121.90	106.20	106.46	105.67	106.12	106.28	106.16
26	60.65	48.75	47.88	45.97	45.35	46.93	46.23
28	58.25	55.77	49.20	48.40	52.57	52.90	52.58
35	105.50	93.85	94.10	93.26	93.70	93.84	93.80

The EPA protocols suggest that a monitoring well be purged and a sample collected within the first two hours or the sample may not be representative of the groundwater. Geological conditions at Plot M make it very difficult to follow the EPA guidance. Many of the monitoring wells at Plot M have been placed in clay-rich units with very low permeability. Recharge to these monitoring wells over a two-hour period is insufficient to obtain an appropriate volume (up to one gallon) of water to conduct the analytical tests. The EPA criteria applies to situations where sensitive constituents such as volatile organic chemicals are of concern. Groundwater analyses at Plot M are for radioactive constituents, especially hydrogen-3 which is less sensitive to chemical or physical loss from the groundwater than the volatile organic chemicals. However, the EPA sampling protocol was applied for samples collected during 2001, where operationally feasible.

As part of a search for radionuclides other than hydrogen-3 in the borehole monitoring wells, sets of large volume water samples were collected to obtain greater sensitivity in the analysis. One set of samples was collected on May 22, 2001, and another set was collected November 26, 2001. Samples were collected from all boreholes that yielded sufficient water for analysis. Currently, the samples are only analyzed for strontium-90 and the results are shown in Table 3.4. Strontium-90 concentrations greater than the detection limit of 0.25 pCi/L were found in five of the 13 sampled boreholes. Levels above 0.25 pCi/L would not be expected in this water from fallout, and no other source is known. The highest strontium-90 concentration in 2001 was 1.98 pCi/L in water from Borehole #11 (39 feet). Historically, the highest concentration was found in 1991, 10.7 pCi/L in Borehole #11 (68 feet). In the past, Borehole #6, which is between the buried waste and the stream that flows around Plot M, showed measurable strontium-90 concentrations. The data suggest that small but measurable amounts of strontium-90 have migrated from the waste into the surrounding glacial drift.

TABLE 3.4

Strontium-90 Content of Borehole Water Samples Near Plot M, 2001

(Concentrations in pCi/L)

Borehole Number*	Depth (ft)	Date Collected	Strontium-90
2	39.41	May 22	0.28 ± 0.03
		November 26	0.40 ± 0.04
3	40.00	May 22	< 0.25
		November 26	< 0.25
4	36.05	May 22	< 0.25
		November 26	< 0.25
5	40.20	May 22	< 0.25
		November 26	< 0.25
6	40.30	May 22	0.46 ± 0.03
		November 26	0.39 ± 0.04
8	40.00	May 22	< 0.25
		November 26	< 0.25
9	40.00**	May 22	Dry
		November 26	Dry
10	40.00**	May 22	< 0.25
		November 26	< 0.25
11	39.30	May 22	1.98 ± 0.05
		November 26	1.67 ± 0.14
11	121.90	May 22	< 0.25
		November 26	< 0.25
26	60.65	May 22	0.77 ± 0.03
		November 26	< 0.25
28	58.25	May 22	< 0.25
		November 26	< 0.25
35	105.50	May 22	0.26 ± 0.03
		November 26	0.44 ± 0.04

*See Figure 3.2
**Slant hole

3.2.2 Borehole Water - Site A

In late 1993, four boreholes (BH-41, BH-42, BH-43, and BH-44), were installed at Site A (see Figure 3.3) to improve Site A perimeter monitoring. Borehole #43 has been dry since construction. In 1994, 12 monitoring wells were constructed at Site A to support the expanded characterization of this area. With the characterization study completed in the spring of 1995, the wells were transferred to the monitoring program for continued use as part of the surveillance network. These wells are also shown in Figure 3.3. Although still shown in the figure, the fence was removed in April 1998. Dedicated pumps and associated equipment were installed in July of 1995. In July 2001, Borehole #43 was closed because it was continually dry. Also, Borehole #42 was dry during both scheduled sampling times. The samples are collected semi-annually and analyzed for hydrogen-3, strontium 90, gamma-ray emitters, and metals.

Hydrogen-3 results for all the Site A boreholes are shown in Table 3.5. Water levels were also measured in these boreholes and these measurement results appear in Table 3.6. The hydrogen-3 concentrations were all low, but the pattern throughout the year was consistent. The elevated hydrogen-3 levels in Borehole #41 is probably from the site landfill, while the hydrogen-3 in Borehole #55 and Borehole #56 is most likely from the CP-3 buried biological shield. The results of the strontium-90 analyses are shown in Table 3.7. The elevated strontium-90 results appear to track with elevated hydrogen-3 results. For example, Boreholes #55 and #56 had measurable levels of hydrogen-3 and strontium-90 throughout the year. All gamma-ray emitters were below the detection limit of 1 pCi/L.

The Site A borehole water samples were also analyzed for total (unfiltered) metals. The results are shown in Tables 3.8 to 3.21. The concentrations of the various metals are compared to the State of Illinois Class I Ground Water Quality Standards (GWQS)[27] which were selected because they represent a conservative application of the standards. Some sampling locations contained less than two results because at times the wells were dry or yielded insufficient water for the metals analysis. Those locations that contain three values include the results of a duplicate sample.

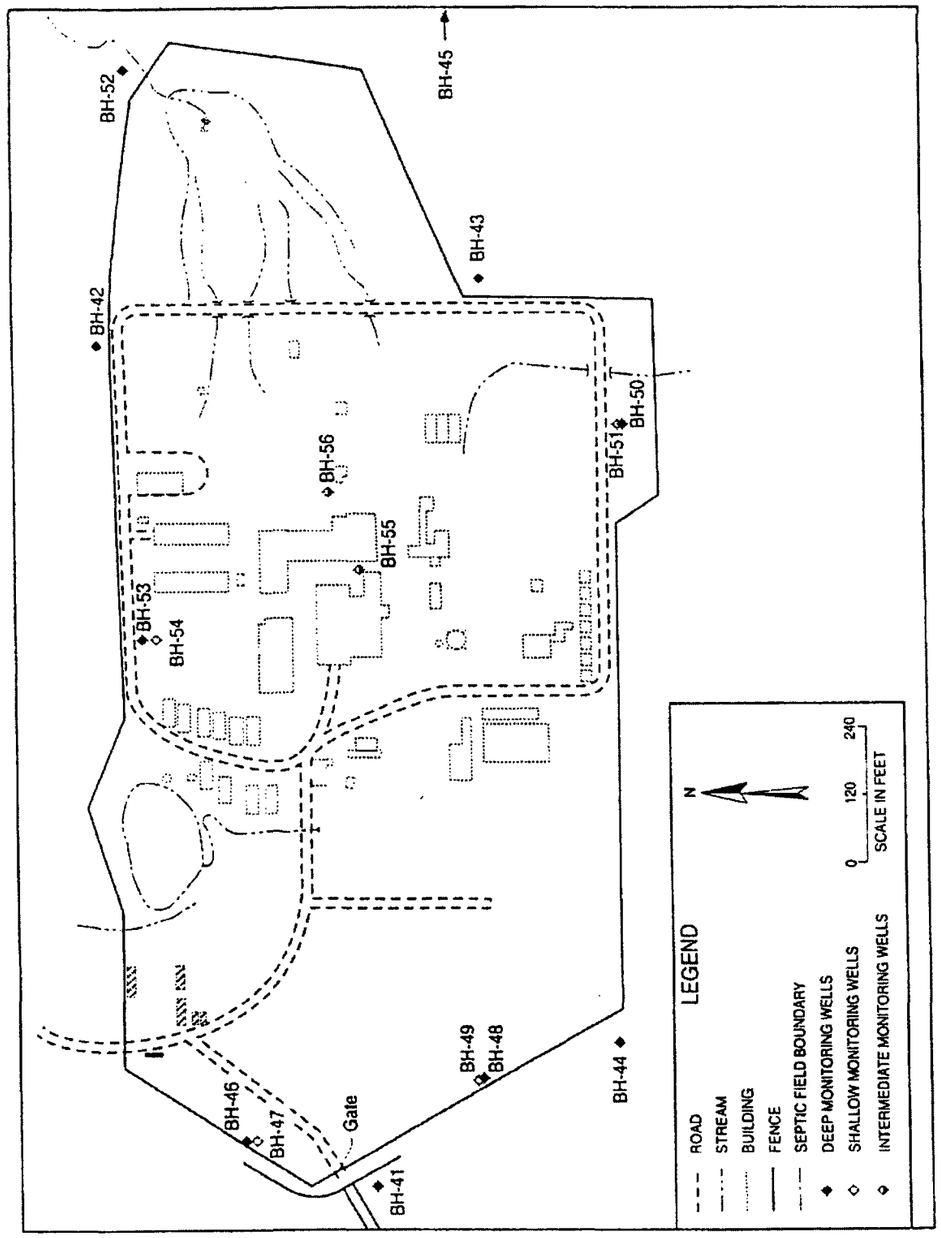


Figure 3.3 Monitoring Wells at Site A

TABLE 3.5

Hydrogen-3 in Site A Borehole Water, 2001

(Concentrations in nCi/L)

Borehole Number	Depth (ft)	Date Collected	
		March 20	October 25
41	25.83	< 0.1	0.5
42	53.01	Dry	Dry
44	31.02	< 0.1	< 0.1
45	166.50	< 0.1	< 0.1
46	190.80	< 0.1	< 0.1
47	44.30	< 0.1	< 0.1
48	192.20	< 0.1	< 0.1
49	45.60	< 0.1	< 0.1
50	162.80	0.1	< 0.1
51	116.40	< 0.1	< 0.1
52	165.00	0.1	0.1
53	177.30	< 0.1	< 0.1
54	63.40	0.2	0.2
55	87.20	7.7	7.5
56	102.40	4.3	4.4

TABLE 3.6

Water Level Measurements in Boreholes Near Site A, 2001
(Units in feet below the benchmark at the top of the well)

Borehole Number	Depth to Bottom (ft)	Date Measured	
		March 20	October 25
41	25.83	2.40	7.53
42	53.01	Dry	Dry
44	31.02	2.60	7.10
45	166.50	142.00	141.76
46	190.80	156.45	156.31
47	44.30	8.90	12.37
48	192.20	158.95	158.75
49	45.60	12.65	13.45
50	162.80	107.15	107.15
51	116.40	102.05	102.17
52	165.00	131.61	131.37
53	177.30	149.41	149.21
54	63.40	55.42	55.56
55	87.20	79.52	82.65
56	102.40	88.60	87.98

TABLE 3.7

Strontium-90 Content of Borehole Water Samples Near Site A, 2001
(Concentrations in pCi/L)

Borehole Number*	Depth (ft)	Date Collected	
		March 20	October 25
41	25	0.38 ± 0.02	< 0.25
42	53	Dry	Dry
44	31	< 0.25	< 0.25
45	166	< 0.25	< 0.25
46	190	< 0.25	< 0.25
47	44	< 0.25	< 0.25
48	192	< 0.25	< 0.25
49	45	< 0.25	< 0.25
50	162	< 0.25	< 0.25
51	116	< 0.25	< 0.25
52	165	< 0.25	< 0.25
53	177	< 0.25	< 0.25
54	63	< 0.25	< 0.25
55	87	7.78 ± 0.08	6.71 ± 0.53
56	102	2.30 ± 0.05	3.63 ± 0.29

* See Figure 3.9

TABLE 3.8

Chemical Constituents in Site A Borehole 41, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0066	< 0.0015	0.0117	0.0500
Beryllium	2	0.0007	< 0.0002	0.0012	0.0040
Cadmium	2	0.0005	< 0.0001	0.0010	0.0050
Chromium	2	0.0652	0.0240	**0.1065**	0.1000
Copper	2	0.0560	< 0.0150	0.0970	0.6500
Lead	2	**0.0281**	0.0059	**0.0503**	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0627	< 0.0200	**0.1055**	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0020	0.0018	**0.0022**	0.0020
Zinc	2	0.1879	0.0932	0.2826	5.0000

TABLE 3.9

Chemical Constituents in Site A Borehole 44, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0022	< 0.0015	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0240	0.0240	0.0240	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0020	0.0020	0.0020	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	-	-	< 0.0200	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0479	0.0431	0.0527	5.0000

TABLE 3.10

Chemical Constituents in Site A Borehole 45, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0028	0.0027	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0245	0.0240	0.0250	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0020	0.0020	0.0021	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	-	-	< 0.0200	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0219	0.0102	0.0336	5.0000

TABLE 3.11

Chemical Constituents in Site A Borehole 46, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0022	< 0.0015	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0007	0.0002	0.0013	0.0050
Chromium	2	0.0240	0.0240	0.0240	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0031	0.0031	0.0032	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0278	< 0.0200	0.0357	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0016	< 0.0010	0.0022	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0793	0.0150	0.1437	5.0000

TABLE 3.12

Chemical Constituents in Site A Borehole 47, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0022	< 0.0015	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0240	0.0240	0.0240	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0020	0.0020	0.0020	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	-	-	< 0.0200	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0010	< 0.0005	0.0016	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0287	0.0206	0.0369	5.0000

TABLE 3.13

Chemical Constituents in Site A Borehole 48, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0022	< 0.0015	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0240	0.0240	0.0240	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0020	0.0020	0.0020	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	-	-	< 0.0200	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0010	< 0.0005	0.0015	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0090	< 0.0080	0.0100	5.0000

TABLE 3.14

Chemical Constituents in Site A Borehole 49, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0076	0.0059	0.0094	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0002	< 0.0001	0.0003	0.0050
Chromium	2	0.0263	0.0240	0.0286	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0030	0.0020	0.0040	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0233	< 0.0200	0.0266	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0022	0.0018	0.0026	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0524	0.0406	0.0643	5.0000

TABLE 3.15

Chemical Constituents in Site A Borehole 50, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0063	0.0044	0.0082	0.0500
Beryllium	2	0.0003	0.0003	0.0003	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0412	0.0240	0.0584	0.1000
Copper	2	-	-	< 0.0198	0.6500
Lead	2	**0.0119**	**0.0083**	**0.0156**	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0350	< 0.0200	0.0500	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0009	< 0.0005	0.0014	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.0857	0.0536	0.1178	5.0000

TABLE 3.16

Chemical Constituents in Site A Borehole 51, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	3	-	-	< 0.0030	0.0060
Arsenic	3	0.0077	0.0066	0.0097	0.0500
Beryllium	3	-	-	< 0.0002	0.0040
Cadmium	3	0.0001	< 0.0001	0.0002	0.0050
Chromium	3	0.0240	0.0240	0.0240	0.1000
Copper	3	0.0170	< 0.0150	0.0210	0.6500
Lead	3	0.0020	0.0020	0.0020	0.0075
Mercury	3	-	-	< 0.0001	0.0020
Nickel	3	-	-	< 0.0200	0.1000
Selenium	3	0.0023	< 0.0020	0.0030	0.0500
Silver	3	-	-	< 0.0010	0.0500
Thallium	3	0.0018	0.0018	0.0020	0.0020
Zinc	3	0.0269	< 0.0097	0.0574	5.0000

TABLE 3.17

Chemical Constituents in Site A Borehole 52, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0022	< 0.0015	0.0030	0.0500
Beryllium	2	-	-	< 0.0002	0.0040
Cadmium	2	0.0001	< 0.0001	0.0002	0.0050
Chromium	2	0.0240	0.0240	0.0240	0.1000
Copper	2	-	-	< 0.0150	0.6500
Lead	2	0.0020	0.0020	0.0020	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	-	-	< 0.0200	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	-	-	< 0.0096	5.0000

TABLE 3.18

Chemical Constituents in Site A Borehole 53, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	3	-	-	< 0.0030	0.0060
Arsenic	3	0.0114	0.0090	0.0128	0.0500
Beryllium	3	-	-	< 0.0002	0.0040
Cadmium	3	0.0001	< 0.0001	0.0002	0.0050
Chromium	3	0.0240	0.0240	0.0240	0.1000
Copper	3	-	-	< 0.0150	0.6500
Lead	3	0.0020	0.0020	0.0020	0.0075
Mercury	3	-	-	< 0.0001	0.0020
Nickel	3	-	-	< 0.0200	0.1000
Selenium	3	0.0026	< 0.0020	0.0030	0.0500
Silver	3	0.0015	< 0.0005	0.0030	0.0500
Thallium	3	0.0019	0.0018	0.0020	0.0020
Zinc	3	0.0124	< 0.0080	0.0212	5.0000

TABLE 3.19

Chemical Constituents in Site A Borehole 54, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0279	0.0216	0.0343	0.0500
Beryllium	2	0.0004	< 0.0002	0.0006	0.0040
Cadmium	2	0.0004	0.0002	0.0006	0.0050
Chromium	2	0.0261	0.0240	0.0282	0.1000
Copper	2	0.0273	< 0.0150	0.0397	0.6500
Lead	2	**0.0241**	**0.0098**	**0.0385**	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0457	0.0272	0.0642	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.1110	0.0522	0.1698	5.0000

TABLE 3.20

Chemical Constituents in Site A Borehole 55, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0483	0.0193	**0.0774**	0.0500
Beryllium	2	0.0006	0.0004	0.0009	0.0040
Cadmium	2	0.0007	0.0003	0.0012	0.0050
Chromium	2	0.0312	0.0240	0.0385	0.1000
Copper	2	0.0701	< 0.0150	0.1252	0.6500
Lead	2	**0.0454**	**0.0169**	**0.0740**	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	0.0622	< 0.0208	**0.1036**	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	-	-	< 0.0010	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.2373	0.1179	0.3567	5.0000

TABLE 3.21

Chemical Constituents in Site A Borehole 56, 2001

(Concentrations in mg/L)

Constituent	No. of Samples	Concentrations Avg.	Min.	Max.	GWQS
Antimony	2	-	-	< 0.0030	0.0060
Arsenic	2	0.0349	0.0068	**0.0630**	0.0500
Beryllium	2	0.0004	< 0.0001	0.0008	0.0040
Cadmium	2	0.0004	< 0.0001	0.0008	0.0050
Chromium	2	**0.1334**	0.0240	**0.2428**	0.1000
Copper	2	0.0509	< 0.0150	0.0869	0.6500
Lead	2	**0.0316**	0.0020	**0.0613**	0.0075
Mercury	2	-	-	< 0.0001	0.0020
Nickel	2	**0.1176**	< 0.0200	**0.2153**	0.1000
Selenium	2	0.0025	< 0.0020	0.0030	0.0500
Silver	2	0.0030	0.0013	0.0047	0.0500
Thallium	2	0.0019	0.0018	0.0020	0.0020
Zinc	2	0.1353	0.0595	0.2112	5.0000

Non Responsive

Non Responsive

TABLE 3.22

Hydrogen-3 in Dolomite Holes, 2001

(Concentrations in nCi/L)

Dolomite Hole Number	Date Collected			
	March 7	May 8	September 18	November 19
1	< 0.1	< 0.1	< 0.1	< 0.1
2	< 0.1	< 0.1	0.1	< 0.1
3	1.6	1.4	1.4	1.6
4	0.1	0.1	0.1	0.2
5	< 0.1	< 0.1	< 0.1	< 0.1
9	0.8	0.7	1.2	1.4
10	2.1	2.1	2.0	1.8
11	2.4	2.4	2.3	2.4
12	2.5	2.5	2.8	2.2
13	1.8	1.8	1.8	1.8
14	3.0	2.9	2.7	2.7
15	1.7	2.0	1.8	2.2
17	0.3	0.4	0.3	0.4
18	< 0.1	< 0.1	< 0.1	< 0.1

TABLE 3.23

Water Level Measurements in Dolomite Holes 2001

(Units in feet below the benchmark at the top of the well)

Dolomite Hole Number	Date Measured			
	March 7	May 8	September 18	November 19
1	161.40	161.25	162.10	161.34
2	139.80	139.90	140.59	139.71
3	98.25	98.39	99.11	98.31
4	93.48	93.67	94.37	93.47
5	78.20	78.42	79.10	78.48
9	72.90	72.50	73.02	72.72
10	64.00	64.22	64.95	64.35
11	76.10	76.35	77.07	75.98
12	77.17	77.39	78.10	77.16
13	77.80	78.05	78.78	78.06
14	72.20	72.42	73.12	72.20
15	79.85	80.04	80.50	79.87
17	75.05	75.30	76.00	75.04
18	143.95	143.68	144.29	143.82

In December 1993, DH 11 through DH 14 were grouted with cement to 535 ft MSL. The purpose of the grouting was to seal off the lower dolomite fractures that are connected to the hand-pumped picnic wells in the Red Gate Woods area. It is speculated that these lower fractures allow elevated levels of hydrogen-3 in the dolomite holes to migrate to the picnic well. In addition, covers to three of the dolomite holes were repaired in December 1993.

In September 1994, three of the dolomite holes, DH 6, DH 7, and DH 8, were abandoned because the wells were not sealed into the dolomite, but were open to the glacial till. As such, they were not sampling dolomite water. Borehole #40 was also abandoned at the same time because the well casing was probably compromised. In accordance with well sealing procedures established by the Illinois Environmental Protection Agency, the casing was filled with clean gravel and sand, sealed with bentonite, the casing removed to three feet below the ground level, and backfilled with clean soil. In July 2001, DH 16 was closed because of an obstruction in the pipe that prevented sampling

The results of the hydrogen-3 analyses of the dolomite holes are consistent with concentrations measured in the past. Nine of the dolomite holes had elevated hydrogen-3 concentrations. The highest hydrogen-3 levels are in the eight dolomite holes, DH 9 to DH 15 and DH 17, which are the furthest north and near the surface stream that flows next to Plot M (see Section 3.2). The distribution of hydrogen-3 in these wells supports the USGS interpretation[28] that a large hydrogen-3 plume underlies the stream. The plume has spread downward as well as downgradient resulting in the current configuration of the hydrogen-3 concentrations in the dolomite. The other dolomite hole with elevated hydrogen-3 is DH 3, which is immediately downgradient from Plot M. Previous analyses of soil core samples indicated the presence of hydrogen-3 down to the drift-dolomite interface at DH 3.

Past sampling practices indicate different hydrogen-3 results are obtained depending on sampling methods. Within the dolomite hole wells north of Plot M, collection of the sample near the top of the water column (shallow) will result in measurable hydrogen-3 concentrations. Sampling at the bottom of the water column (deep) will result in very low or non-detectable hydrogen-3 concentrations. In addition, samples collected at any depth after purging, removing up to 700 L of water before sampling, will result in samples with hydrogen-3 concentrations that are very low or non-detectable.

The explanation for the differences in hydrogen-3 concentration is that the hydrogen-3 is moving horizontally in the uppermost fractures of the dolomite. The hydrogen-3 is in a narrow band of the water column in the dolomite hole. Where a sample is collected with a bailer, this hydrogen-3 zone is the area sampled resulting in measurable levels of hydrogen-3 in the sample. However, when the dolomite hole is purged, the volume of recharge water from other fractures that are free of hydrogen-3 is such that the hydrogen-3 concentration in the sample is generally at the detection limit. If the next quarter sample is collected without purging, the hydrogen-3 concentration is at the same level as earlier samples indicating that the fracture flow rapidly reached an equilibrium condition.

Non Responsive

Non Responsive

TABLE 3.24

Hydrogen-3 Content of Wells Near Site A/Plot M, 2001

(Concentrations in nCi/L)

Date Collected	Red Gate North 5160	Opposite Red Gate 5159	300 yds. East Red Gate 5158
January 3	1.52	0.20	< 0.1
January 17	1.50	0.19	-
February 7	1.50	0.26	0.12
February 21	1.45	0.23	-
March 6	1.50	0.21	0.13
March 21	1.47	0.20	-
April 4	1.45	0.23	0.18
April 18	1.59	0.23	-
May 2	1.54	0.27	0.11
May 16	1.57	0.20	-
June 5	1.55	0.23	0.14
June 20	1.51	0.12	-
July 3	1.50	0.15	< 0.1
July 18	1.52	0.17	-
August 1	1.47	0.17	0.18
August 15	1.54	0.15	-
September 5	1.47	0.10	< 0.1
September 19	1.36	0.15	-
October 3	1.38	< 0.1	< 0.1
October 17	1.54	< 0.1	-
November 7	1.41	0.10	0.15
November 21	1.48	< 0.1	-
December 5	1.46	0.11	0.13
December 19	1.44	< 0.1	-
Average	1.49	0.16	0.12

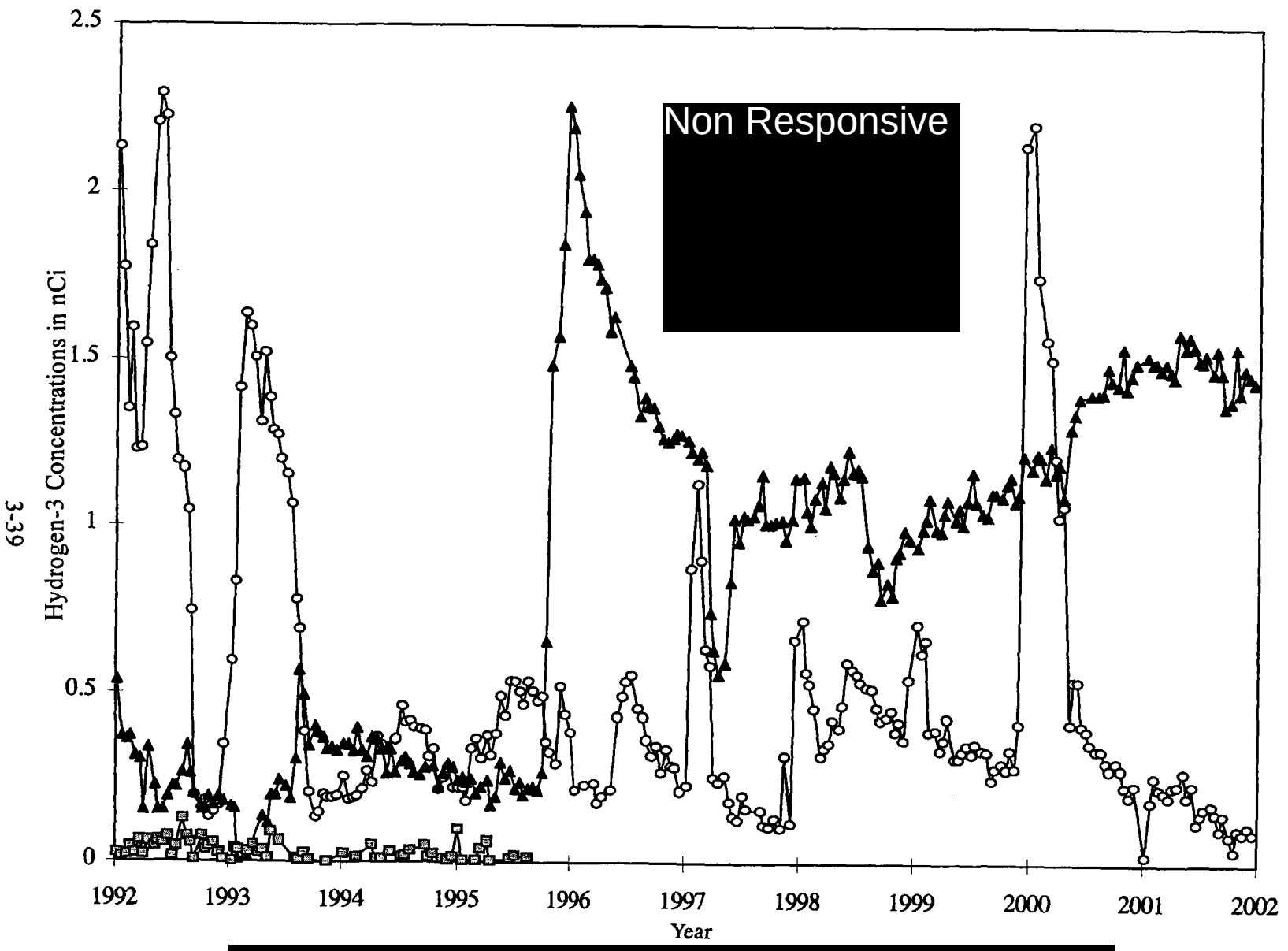
TABLE 3.25

Annual Maximum and Average Hydrogen-3 Concentrations
in the Red Gate Woods Wells

(Concentrations in nCi/L)

Year	Red Gate Woods North (#5160)		Red Gate Woods (#5167)		Opposite Red Gate Woods (#5159)	
	Maximum	Annual Average	Maximum	Annual Average	Maximum	Annual Average
1976			11.0	6.1	4.4	1.90
1977			9.2	8.2	5.1	2.10
1978			12.2	7.5	2.4	1.30
1979			11.4	7.1	2.6	0.96
1980			8.8	7.0	1.6	1.02
1981			9.6	4.3	2.1	1.06
1982			11.0	4.8	3.2	0.79
1983			5.1	2.2	1.8	0.95
1984			2.7	1.2	1.70	0.70
1985			2.5	1.0	1.60	0.69
1986			3.4	1.3	0.94	0.60
1987			3.3	1.6	0.73	0.54
1988	0.30	0.19	0.48	0.18	1.91	1.32
1989	0.41	0.27	0.46	0.30	0.92	0.61
1990	0.52	0.22	0.25	0.12	2.07	1.14
1991	0.80	0.35	0.21	< 0.1	2.26	1.43
1992	0.54	0.25	0.13	< 0.1	2.29	1.15
1993	0.57	0.23	< 0.1	< 0.1	1.63	0.87
1994	0.40	0.31	< 0.1	< 0.1	0.46	0.30
1995	2.26	0.51	< 0.1	< 0.1	0.54	0.40
1996	2.19	1.56	Closed/Sealed November 1995		0.55	0.33
1997	1.26	1.00			1.13	0.35
1998	1.23	1.03			0.72	0.47
1999	1.22	1.07			2.14	0.45
2000	1.54	1.33			2.20	0.70
2001	1.59	1.49			0.27	0.16

*The replacement well (#5160) was installed in July 1988.



Non Responsive

Non Responsive

TABLE 3.26

Inorganic Constituents in Red Gate Woods North Non Responsive

(Concentrations in mg/L)

Inorganic Constituent	February	May	August	November	GWQS*
Arsenic	< 0.00030	< 0.0030	< 0.0030	< 0.0030	0.05
Barium	< 0.010	< 0.010	< 0.010	< 0.010	2.0
Beryllium	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.004
Cadmium	< 0.0002	< 0.0002	< 0.0002	0.0004	0.005
Chloride	21	22	21	20	200
Chromium	< 0.024	< 0.024	< 0.024	< 0.024	0.1
Cobalt	< 0.016	< 0.016	< 0.016	< 0.016	1.0
Copper	< 0.015	**0.92**	< 0.015	0.17	0.65
Fluoride	0.112	0.140	0.106	0.134	4.0
Iron	< 0.020	**83.9**	< 0.020	**53.0**	5.0
Lead	< 0.002	**0.160**	< 0.002	**0.084**	0.0075
Manganese	0.018	**0.634**	< 0.010	**0.502**	0.15
Mercury	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.002
Nickel	< 0.02	< 0.02	< 0.02	< 0.02	0.1
pH	**9.31**	8.74	8.57	**9.30**	6.5-9.0
Silver	< 0.001	< 0.001	< 0.001	< 0.001	0.05
Sulfate	129	120	86	185	400
Thallium	< 0.002	< 0.002	< 0.002	< 0.002	0.002
Vanadium	< 0.032	< 0.032	< 0.032	< 0.032	-
Zinc	0.036	**41.40**	0.032	**18.55**	5.0

*State of Illinois Class I Ground Water Quality Standards (GWQS).[27]

Non Responsive

4.0 SUMMARY OF POTENTIAL RADIATION DOSE AND RISK ESTIMATES

4.1 Dose Estimates

The dose from drinking water to an individual exposed to radionuclides associated with Plot M can be estimated employing the DOE methodology. If a hypothetical individual were exposed continuously to hydrogen-3 at various locations near Plot M, the dose could be estimated. Assuming a person drank water from Location #9 or the seep (Location #6), or drank water from Non Responsive, the dose from exposure for all of 2001 at the maximum and annual average concentrations is collected in Table 4.1. This scenario assumes that the individual's sole source of water is at the identified location.

A more meaningful estimation is for the occasional visitor to the Plot M area. Assuming a visitor drinks one liter of water from the surface stream or picnic wells, the dose from this exposure is estimated and presented in Table 4.2. The maximum total dose received by an occasional visitor is the combination of surface water and drinking water from the Red Gate Woods North Non Responsive This maximum dose would be 0.0001 mrem per visit.

In order to put the doses into perspective, comparisons can be made to annual average doses received by the public from natural or other generally accepted sources of radiation. These are listed in Table 4.3. It is obvious that the magnitude of the doses potentially received near Plot M from residual radioactive substances remaining from work conducted in this area are insignificant compared to these sources.

4.2 Risk Estimates

Risk estimates of possible health effects from radiation doses to the public from Plot M have been made to provide another perspective in interpreting the radiation doses.

TABLE 4.1

Dose From Continuous Exposure to Hydrogen-3 at Selected Locations, 2001

Pathway	Maximum Conc	Maximum Dose	Annual Average Conc	Annual Average Dose	Average Carcinogenic Risk
Surface Water					
Seep	66.9 nCi/L	3.1 mrem/y	20.5 nCi/L	0.9 mrem/y	6×10^{-7}
Location #9	22.5 nCi/L	1.0 mrem/y	11.2 nCi/L	0.5 mrem/y	4×10^{-7}
Well Water					
Red Gate Woods Non Responsive)	1.59 nCi/L	0.073 mrem/y	1.49 nCi/L	0.069 mrem/y	5×10^{-8}

TABLE 4.2

Estimates of Hydrogen-3 Exposures to a Casual Visitor to Plot M, 2001

Pathway	Quantity	Maximum Dose	Annual Average	Average Carcinogenic Risk
Surface Water				
Seep	One Liter	0.004 mrem	0.001 mrem	7×10^{-10}
Location #9	One Liter	0.001 mrem	0.0007 mrem	5×10^{-10}
Well Water				
Red Gate Woods Non Responsive	One Liter	0.00010 mrem	0.00009 mrem	6×10^{-11}

TABLE 4.3

Annual Average Dose Equivalent
in the U. S. Population*

Source	(mrem)
Natural Sources	
Radon	200
Internal (^{40}K and ^{226}Ra)	39
Cosmic	28
Terrestrial	28
Medical	
Diagnostic X-rays	39
Nuclear Medicine	14
Consumer Products	
Domestic Water Supplies, Building Materials, etc.	10
Occupational (Medical Radiology, Industrial Radiography, Research, etc.)	1
Nuclear Fuel Cycle	< 1
Fallout	< 1
Other Miscellaneous sources	< 1
Total	360

*NCRP report No. 93.[30]

Estimated for carcinogenic risk, the risk of contracting cancer from these exposures, is included in Table 4.1 and Table 4.2 for the average exposure scenario. Based on the BIER V report,[31] a dose of one mrem/y equates to an increased risk of 0.7×10^{-6}. This conversion ratio is used in these tables. The risks are estimated to be in addition to the normal incident rate of cancer in the general population. For example, a carcinogenic risk of 10^{-7} would mean one additional cancer to 10,000,000 people exposed under the prescribed conditions. The EPA environmental protection standards are generally based on an acceptable risk between 10^{-4} and 10^{-6}. This would imply that a risk of greater than 10^{-4} would be unacceptable and a risk of less than 10^{-6} would be acceptable. Examination of Table 4.1 indicates that even under the very conservative assumptions of sole source use of the water at Plot M annual average concentrations, the risk is less than the EPA recommendation. For the Table 4.2 hypothetical dose to an occasional visitor of 0.00001 mrem, the risk would be about 10^{-11}. The risk from exposure to radionuclides at Plot M can be compared to the risk associated with natural events. A few examples are collected in Table 4.4. The risk from the naturally-occurring sources of radioactivity listed in Table 4.3 is estimated to be about one additional cancer in a population of 8,000. Therefore, the monitoring program results have established that radioactivity at Plot M is very low and does not endanger the health or safety of those living in the area or visiting the site.

TABLE 4.4

Risk of Death From Natural Events

Cause	Risk
Lightning Strike	5×10^{-8}
Tornado	1×10^{-7}
Flood	1×10^{-7}
Hurricane	2.5×10^{-7}
Drowning	8×10^{-6}
Air Travel	3×10^{-6}
Firearms	2×10^{-6}

5.0 REFERENCES

1. Golchert, N. W. and Sedlet, J., *Formerly Utilized MED/AEC Sites Remedial Action Program - Radiological Survey of Site A, Palos Park Forest Preserve, Chicago, Illinois,* U. S. Department of Energy Report DOE/EV-0005/7 (April 1978).

2. Golchert, N. W., Sedlet, J., and Hayes, K. A., *Environmental Surveillance of the Palos Park Forest Preserve,* U. S. Department of Energy Report ANL-83-6 (January 1983).

3. Golchert, N. W. and Sedlet, J., *Site Surveillance and Maintenance Program for Palos Park - Report for 1982,* Argonne National Laboratory (available from the authors) (April 1984).

4. Golchert, N. W. and Sedlet, J., *Site Surveillance and Maintenance Program for Palos Park - Report for 1983,* Argonne National Laboratory (available from the authors) (June 1984).

5. Golchert, N. W. and Sedlet, J., *Site Surveillance and Maintenance Program for Palos Park - Report for 1984,* Argonne National Laboratory (available from the authors) (April 1985).

6. Golchert, N. W. and Sedlet, J., *Site Surveillance and Maintenance Program for Palos Park - Report for 1985,* U. S. Department of Energy Report ANL-86-25 (April 1986).

7. Golchert, N. W., *Site Surveillance and Maintenance Program for Palos Park - Report for 1986,* U. S. Department of Energy Report ANL-87-8 (April 1987).

8. Golchert, N. W., *Site Surveillance and Maintenance Program for Palos Park - Report for 1987,* U. S. Department of Energy Report ANL-88-12 (April 1988).

9. Golchert, N. W., *Site Surveillance and Maintenance Program for Palos Park - Report for 1988,* U. S. Department of Energy Report ANL-89/7 (April 1989).

10. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1989,* U. S. Department of Energy Report ANL-90/7 (April 1990).

11. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1990,* U. S. Department of Energy Report ANL-91/2 (May 1991).

12. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1991,* U. S. Department of Energy Report ANL-92/13 (May 1992).

13. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1992,* U. S. Department of Energy Report ANL-93/4 (May 1993).

14. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1993,* U. S. Department of Energy Report ANL-94/9 (May 1994).

15. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1994,* U. S. Department of Energy Report ANL-95/7 (May 1995).

16. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1995,* U. S. Department of Energy Report ANL-96/2 (June 1996).

17. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1996,* U. S. Department of Energy Report ANL-97/5 (May 1997).

18. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1997,* U. S. Department of Energy Report ANL-98/1 (May 1998).

19. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1998,* U. S. Department of Energy Report, ANL-99/2 (May 1999).

20. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 1999,* U. S. Department of Energy Report, ANL-00/3 (May 2000).

21. Golchert, N. W., *Surveillance of Site A and Plot M - Report for 2000,* U. S. Department of Energy Report, ANL-01/1 (May 2001).

22. U. S. Department of Energy, "Radiation Protection of the Public and the Environment," *DOE Order 5400.5,* February 8, 1990.

23. U. S. Environmental Protection Agency, "National Primary Drinking Water Regulations," 40 CFR Part 141.

24. U. S. Department of Energy, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," *DOE/EH-0173T,* January 1991.

25. International Commission on Radiological Protection, "Reference Man: Anatomical, Physiological, and Metabolic Characteristics," *ICRP Publication 23,* Pergamon Press, New York, NY (1975).

26. U. S. Department of Energy, "Internal Dose Conversion Factors for Calculation of Dose to the Public," *DOE/EH-0071,* July 1988.

27. Illinois Pollution Control Board, Illinois Administrative Code, Title 35, Subtitle F; Chapter I, Part 620, "Ground Water Quality," September 15, 1994.

28. Nicholas, J. R. and Healy, R. W., "Hydrogen-3 Migration From a Low-Level Radioactive-Waste Disposal Site Near Chicago, Illinois," U. S. Geological Survey Water-Supply Paper 2333, 1988.

29. Final report - Hydrogen-3 Migration and Hydrogeological Studies in the Vicinity of Plot M - Palos Forest Preserve, International Technology Corporation Report, Project No. 313433, August 1994.

30. National Council on Radiation Protection and Measurements, *Ionizing Radiation Exposure of the Population of the United States,* NCRP Report No. 93, September 1, 1987.

31. Committee on Biological Effects of Ionizing Radiation, *Health Effects on Populations of Exposure to Low Levels of Ionizing Radiation - BEIR V Report,* National Academy Press, Washington, 1990.

32. Golchert, N. W., Kolzow, R. G., and Moos, L. P., *Argonne National Laboratory-East Site Environmental Report for Calendar Year 2000,* U. S. Department of Energy Report ANL-01/2 (September 2001).

6.0 APPENDICES

6.1 Quality Assurance Program

All nuclear instrumentation is calibrated with standardized sources obtained from or traceable to the U. S. National Institute of Standards and Technology (NIST). The equipment is checked prior to the sample measurements with secondary counting standards to insure proper operation. Samples were periodically analyzed in duplicate or with the addition of known amounts of a radionuclide to check precision and accuracy. Intercomparison samples distributed by the DOE Environmental Measurements Laboratory Quality Assurance Program, a semi-annual distribution of three different sample matrices containing various combinations of radionuclides are analyzed. The results of our participation in this program for 2000 are published in ANL-01/2.[32]

Many factors enter into an overall quality assurance program other than the analytical quality control discussed above. Representative sampling is of prime importance. Appropriate sampling protocols are followed for each type of sampling being conducted. Water samples are pre-treated in a manner designed to maintain the integrity of the analytical constituent. For example, samples for trace radionuclide analyses are acidified immediately after collection to prevent hydrolytic loss of metal ions and filtered to reduce leaching from suspended solids.

The monitoring wells are sampled using the protocols listed in the Resource Conservation and Recovery Act (RCRA) Ground Water Monitoring Technical Enforcement Guidance Document. The volume of water in the casing is determined by measuring the water depth from the surface and the depth to the bottom of the well. This latter measurement also determines whether siltation has occurred that might restrict water movement in the screen area. For those wells in the glacial drift that do not recharge rapidly, the well is emptied and the volume removed is compared to the calculated volume.

In most cases, these volumes are nearly identical. The well is then sampled by bailing with a Teflon bailer. If samples for parameters such as priority pollutants are collected, field parameters for these samples (pH, specific conductance, redox potential, and temperature) are measured per well volume while purging. Most samples are collected for radiological analyses only. For samples in the porous, saturated zone which recharge rapidly, three well volumes are purged using submersible pumps. If field parameters are measured, samples are collected as soon as these readings stabilize. All samples are placed in precleaned bottles, labeled, and preserved. All field measurement and sampling equipment is cleaned by field rinsing with Type II deionized water. The samples are transferred to the analytical laboratory along with a computer floppy disk which generates a one-page list of all samples. This list acts as the chain-of-custody transfer document.

6.2 Applicable Standards

The standard that is relevant to this study is the DOE Order 5400.5 which established a dose limit of 100 mrem/y.[22] The dose limit and dose calculation methodology are applicable to all media: surface water, deep holes, boreholes, and drinking water. The EPA drinking water standard[23] is not applicable to the picnic wells since they do not meet the definition of a public water system. However, the EPA standard of 20 nCi/L for hydrogen-3 may be useful for some comparison purposes.

6.3 Analytical Methods

The analytical methods used to obtain the data in this report are the same as those used in ANL-01/2.[32]

Distribution for ANL-02/1

Internal

A. B. Cohen
T. M. Davis
A. T. Fracaro
N. W. Golchert (25)
J. E. Helt
M. A. Kamiya
R. G. Kolzow
W. D. Luck
D. A. Milinko
L. P. Moos
J. Sedlet
J. L. Tucker
R. A. Wynveen
TIS File

External

ANL-E Library
ANL-W Library, AW-IS
S. Countiss, DOE Carlsbad Area Office
J. Gilmore, DOE Grand Junction Office (10)
S. L. Heston, DOE Chicago Operations Office
B. J. Quirke, DOE Chicago Operations Office
R. Allen, Illinois Department of Nuclear Safety
J. Barnett, U. S. Environmental Protection Agency, Region V
Bedford Park Public Library
T. Hyde, U. S. Environmental Protection Agency
T. Kelleher, Chicago District, Corps of Engineers
R. LaMort, Cook County Board of Commissioners
Librarian, Illinois Department of Nuclear Safety
Mayor of Willow Springs
M. McMullan, U. S. Environmental Protection Agency, Environmental Review Branch
C. Merenowicz, Forest Preserve District of Cook County
J. R. Nicholas, U. S. Geological Survey
T. Ortciger, Illinois Department of Nuclear Safety
L. Regner, U. S. Environmental Protection Agency, Federal Facility Coordinator
S. Shemanski, Cook County Department of Public Health
C. Smith, Illinois Environmental Protection Agency
D. Weber, Forest Preserve District of Cook County